THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE

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ELECTRIC TRAMWAYS IN GERMANY.

A GERMAN engineer in a recent number of the *Street Railway Journal* systematically reviews the status and prospects of German tramways.

He says, to begin with, that most of the companies are in a prosperous condition, although many of the same concerns five or six years ago were making deficits. But this change from adversity to opulence was not accomplished before face values had depreciated enormously, and capital had been written down until the assets were more nearly represented by the new figures. We, in England, know something of the causes which lead to this degradation of capital employed in tramways, and there can be small doubt that in the most notorious current instance, a reduction of capital must be made. In Germany the passing of a law in 1892 favourable to private enterprise resulted in a scramble for concessions which lasted for six years, the municipalities the while laughing up their sleeves and ever squeezing more onerous conditions out of the promoters. Probably the promoters, as distinct from the merely operating, and suffering, companies, made a fine pile while the fun lasted; but directly promotion and construction on the grand scale ceased, and the subsidiary business of working began, it was found that the preliminary estimates of the cost of construction and working were all wrong, and the falling sickness attacked the unhealthy concerns. The inevitable consequences ensued. Construction slackened and ceased, not because the promoter had repented of his sins, or become convinced of his foolishness, but because the public no longer danced to his piping. Maintenance grew worse and worse, not because the operating officials were incompetent, but because the money needed for repairing the material of construction was diverted for the purpose of repairing credit. So the candle was burned at both ends until the crisis came.

Anyone who is cognizant of the history of the B.E.T. will readily apply the parallel. First, the eagerness of the financier; then the blindness of a collection of pseudo-financiers, or capitalists by proxy; with that, engineers' estimates subordinated to and complexioned by schemes and policies having no relation at all to engineering, except of a subterranean nature; afterwards the actual construction by engineers trained and experienced in building steam railways; and, last of all, the running by underpaid officials with insufficient material, handled by an inadequate staff; with, ruling all, a cloud of forms—forms of paper lined and headed—which, being non-sentient, aim only at preventing money being spent; for, say the financiers who rule the forms, to save money is to make it, thus overlooking the simplest of home-truths—that money cannot be put into a closed purse.

Reaction has arrived already, and re-construction must follow in its train, as surely as it did in Germany.

The fever of promotion and construction having passed, leaving the patient healthier after convalescence than before the illness, more attention is being given to maintaining and improving the lines and rolling-stock, which has led to a reduction in working expenses.

The uniform-fare system has been tried and discarded generally in favour of a higher zone fare, and this step was taken first by the municipally-owned tramways.

The use of trailers on the German tramways is constantly increasing.

Whereas double-bogie single-decked cars were much used at one time, opinion has changed gradually until single trucks with as long a wheel-base as possible, in one instance as much as 11 ft. 10 in., have almost superseded them. Air brakes have made little progress, some form of electric brake being preferred even when two or more cars are coupled.

Line lightning arresters are chiefly of the Siemens horn type, but the magnetic blow-out arrester developed by the G.E. Co., of America, is used largely on the cars.

The trolley wheel is used far more than the bow, but the writer remarks that several companies have changed from wheel to bow, but none from bow to wheel. While admitting that the former is sound evidence of the advantages of the bow under certain circumstances, it should be observed that the expense of altering the overhead line for the use of the trolley wheel, when once it had been constructed to suit the bow, would be prohibitive.

New rails weigh from 80 to 120 lb. per yard, and the height is being increased from 6 in. to 7 in., and even 8¼ in.

Where companies are concerned, municipalities are fond of insisting on asphalt paving, which is costly to maintain, and does not keep the foundations watertight; but, when a city owns the tramways, it is tempted to make use of a more durable, if somewhat noisier, pavement, at least, on each side of the rails.

Rail joints are made chiefly with the Thermit process, or with the Melaun mechanical joint, and both cost about the same.

At present there is a lack of standards in every direction, but it is difficult to see how a business which was not born so many years ago, and has been growing at a rapid pace ever since, could be expected to have settled down to standards which are the outcome of maturity. Nevertheless, the time has arrived when standards can be fixed without strangling enterprise and ingenuity, as we have seen in England, and the Germans are not generally far behind in matters of order and precision. Their overhead construction is all much on the same lines already, and a standard specification for track material has been adopted recently by the Street Railway Association, and may be read in the *Street Railway Journal* of January 5th.

The use on cars of some sort of registering meter as a check on the consumption of energy is wide-spread throughout Germany, and wherever watt-hour meters, or mere current time meters have been installed, money has been saved. One day the English tramways, which have to pay 1½d. or more for the unit, will follow suit to their advantage, but at present, either from positive ignorance, or from slackness, or, in the case of municipal tramways, because the labour party is strongly represented in the Council, the progress made towards economy in this direction is not marked.

The pernicious tipping system is in vogue in Germany, conductors often making as much out of tips as by their wages, and the best lines from the conductors' point of view are those which are used chiefly by the working classes.

Speaking broadly, we gather that the financial condition of the German and Prussian tramways is somewhat better than that of ours, but they have had nearly five years longer in which to get over the ravages of the promoter, and their construction has not been as costly, on the average, as the construction of the British tramways. Moreover, their prospects are rather brighter, for the majority are not owned, as in England, by the municipal authorities, and when once an undertaking has been purged of its original sin, and is in charge of enlightened and practical men, there is more hope of its financial success when run by a company than when owned and operated by the citizens at large.

Municipal Engineers in Conference.

Next week will witness the twelfth annual conference of the Incorporated Municipal Electrical Association, held this year at Sheffield, on the 25th, and three following days of this month.

A casual perusal of the list of subjects to be discussed leaves one with an impression of modesty on the part of the executive, at least in comparison with recent years. We do not for a moment suggest that lack in number of subjects implies lessened value in the proceedings; on the contrary, "less paper" and "more discussion" should be the order of the day on occasions of this kind.

As to the subjects to be dealt with, the first day's proceedings include a paper by Mr. R. L. Acland on the perennial question of electricity supply to outlying districts, a matter which, in one shape or another, has called forth many and diverse expressions of opinion.

Passing over Wednesday, which will, weather permitting, be devoted to enjoying the scenic beauties of the Dukeries, and the more sober business of the annual general meeting on Thursday morning, the afternoon of that day is devoted to the reading and discussion of three papers, all on subjects more or less apropos at the present time.

Mr. C. E. C. Shawfield deals with the question of cheap power supply by municipalities; he is, we believe, a "whole hogger" who deprecates half-hearted measures and cast-iron systems of dealing with this class of business, and quite rightly.

Mr. H. R. Burnett will deal with "the costs of, or charges for, electricity supply," we don't know which. Both subjects are important and have been freely discussed on previous occasions; their inter-dependence is a difficult question to decide, and sinks into insignificance in comparison with the greater commercial question of systems of charging.

Mr. C. H. Yeaman introduces the important question of depreciation, a matter which we ourselves have never ceased to urge on municipal undertakings and others, and which electrical committees, under pressure from their engineers, are beginning to appreciate at its true significance.

In another part of this issue two municipal engineers discuss at some length the same question, on lines which, we believe, meet with general acceptance. Mr. Yeaman's contribution will, however, be welcome, if only as a reminder, on an appropriate occasion, to those members who have so far neglected the matter.

To Friday morning are reserved papers by Mr. R. McCourt on the value of photometry in central station work, and by Mr. A. J. Cridge on alternating-current distribution. Both subjects are of interest, photometry especially. The value of the photometer in central station work, when properly handled, cannot be disputed, except, perhaps, by the committee-man with an eye for public lighting; and, if only because it is revealing to us the long-standing delinquencies of the common glow-lamp, it is commercially worth its weight in gold.

One cannot help a feeling of surprise that in Sheffield, with its wealth of important industrial concerns, only one of the latter should be open to the visitors on thi

auspicious occasion, although that one, Messrs. Vickers, Maxim's works, leaves little to be desired.

In conclusion, we wish the Association every success in its forthcoming convention, which, under the presidency of Mr. S. E. Fedden, will doubtless prove fully as interesting and instructive as its predecessors in years gone by.

Tramways, Railways, and Power Companies.

OUR annual Table of Electric Tramways, Railways, and Power Companies is issued with this number of the ELECTRICAL REVIEW; we trust that it may prove useful to our readers. Although the rate of increase has fallen off, the number of tramways nevertheless shows fair progress. We regret that the number of railways is unchanged, but several which were not in operation at this time last year are now open for traffic. We hope that in the future—distant, it may be—this section will become at least as important as the tramways section. There are a few additions to the list of power companies, representing undertakings already in full swing; unfortunately, some of the older projects are still dormant.

We tender our hearty thanks to the managers of these various classes of undertakings for their kind assistance in the collection of data; for various reasons it is not always possible to obtain the desired information, but it is a pleasure to state that an extremely small percentage of such cases occurs in connection with this Table.

THE ENGINEERING CONFERENCE.

THE fourth Conference of the Institution of Civil Engineers opened on Wednesday last, with an inaugural address by Sir Alexander Kennedy, the President of the Institution, the only fault of which was that it was too short. Yet that fault was really a merit, for the Conference was anxious to get to work as speedily as possible; moreover, it was well that the President should set an example of the brevity and relevancy which he commended to the notice of his audience, enforcing the commendation with a command to attend to it under penalty of prompt suppression by the sectional chairmen, whether for discursiveness or irrelevance. The keynote of the address was the catholicity of the aims of the Institution, a note that he found in its Charter. With some ingenuity Sir Alexander contrived to read into the charter of 1828 many things, such as railway and electrical engineering, which, not then being invented, could not be included specifically. Railways were supposed to be implicitly and prophetically included under traffic, and electricity under a general clause relating to machinery of all kinds. Since the Civils included in their programme all and every kind of engineering, it followed that no expert in any branch should be outside the fold, and if any member knew of such an anomaly, his plain duty was to point out to such expert his untenable position, and to bring the straggler into line with the rest.

The very catholicity of the Institution, however, led to a danger of narrow exclusiveness against which the President warned his hearers. No man could be an expert in all subjects, and there was a danger that each would attend only to papers in his own branch, and so miss one of the main advantages of the Conference. By wandering from section to section, the members not only escaped from their narrow groove, but found out how very interesting those other branches were; and, incidentally, discovered how much easier it was to dogmatise in others' business than in one's own. Turning to the programme of the present Conference, Sir Alexander Kennedy pointed out that it passed even the wide and catholic aims of the Institution by including matters that were not directly engineering. He instanced the paper on "Harbour and Dock Requirements as Affected by Development of Shipping," as lying outside the range of engineering and dealing rather with a larger matter of mercantile policy; the paper on "Electro-Metallurgy," which brought in chemical questions, and that on "The Action between Rail and Wheel," a question of pure physics, little understood though of constant occurrence; while Mr. Burstall's paper on "Maintenance Charges" dealt with finance.

The charge had been brought against the arrangement of the sections that the order was illogical; that ships were known before railways, or harbours, docks and canals; and that mining and machinery also preceded shipbuilding. The reply was that the order was at least in accord with that adopted in the charter. True, there were then no railways, but these came in under the general head of roads. It was remarkable that, whereas in the early days of the Institution, people thought they had little to learn about road-making, that was now one of the subjects most hotly debated, not only by engineers, but by the omniscient writers in the Press, and even by its correspondents. The address closed with a reference to the plan of proceedings. The papers would be merely notes, read within 10 minutes, and intended but as introductory to discussion. The chairman would exercise despotic authority and repress any speaker who failed to be brief and to the point. A few minutes would be allowed to each opener for reply on the discussion. The afternoons would be given up to visits to the various works, and arrangements had been made for verbatim reports, to be corrected by the speakers themselves, provided they were prompt in returning the proofs.

It is obvious that the success of the excellent plan laid down depends largely on the tact and discretion of the chairmen of the several sections. The rule of brevity can hardly fail to be observed, for the limits of time are inexorable; but relevancy is another matter. The first paper read in Section VII was hardly really *discussed* at all. Of those who professed to discuss Mr. A. C. Swinton's "Electrical Transmission Gears on Motor Vehicles," scarcely one referred to the author's plan. The rest had each his own way of doing the same thing, which he talked about so long as he was permitted. Below will be found articles on some of the papers already read. Abstracts of other papers, and of the discussions arising from them, will appear in due course. The programme of the Conference covers a great variety of subjects, and well bears out the claim of catholicity made by the President on behalf of the Institution. It is impossible that these matters can be discussed for three days by those best qualified to pronounce an opinion on them without some advance in knowledge on the part of the audience, and some gain in breadth of conception and mutual tolerance in those who take part in the debates.

Steel Specifications.

MR. C. P. SANDBERG, M.Inst.C.E., on Wednesday, in Section I (Railways), revived the discussion, which has long been in progress, upon "The Chemical Composition of Steel Rails and Latest Developments," and the question as to whether the drawing-up of the specification should not be left entirely to the manufacturer. Although Mr. Sandberg confined his remarks principally to steel rails, users and manufacturers of steel for other purposes will be interested in the general conclusions arrived at, and the arguments brought forward.

In the first place, it must be clear to all that as the engineer is the adviser of the user, and is responsible for the application of the material for the special purpose for which it is to be employed, he must, therefore, specify the requirements.

For instance, in the case of chilled cast-iron wheels for railway purposes, the principal clause in the specification is that stating that the manufacturer must guarantee to replace any wheel failing to run a certain number of miles; this ensures the maker's using all precautions as to the method of manufacture and chemical composition, in his own interests.

A consulting engineer for a railway requires that the rails shall be capable of carrying a certain load, and shall give satisfactory service for a reasonable number of years, but how this result is to be attained does not enter his province.

The physical properties of the material are all that affect the engineer; it rests with the maker to provide the specified quality by attention to chemical composition, method of manufacture, and such points as rolling rails from large or small ingots, the temperature at which the changes in section are brought about, and all other details involved in producing the finished article.

If steel were a homogeneous substance and if its physical properties were entirely controlled by its chemical composition, the matter would be quite simple, and would have been reduced to standard long ago, but this is very far from being the case.

Another important point to be borne in mind is that the experts employed by the steel manufacturer, through practical experience and the numerous tests applied, so greatly in excess of any tests which the engineer can be cognizant of, are far better qualified to judge the most suitable composition and mode of working for the material available, than could be the case with an engineer. In regard to chemical composition, the steel maker places much more reliance upon results obtained from a small sample ingot, representing each *cast*, than from drillings taken from any portion of the finished article. When a rail in service proves unsatisfactory, breaks, or is too soft and wears badly, chemical analysis is frequently resorted to, to show the cause of failure; however, the results would most probably be misleading, and of little value, for the reason already given, that the material is not homogeneous. Even if the results of analysis were truly representative, in the absence of other particulars as to treatment in the course of manufacture, &c., very little reliable information could be gained.

Probably the most effective criterion for steel for any purpose to which it is to be applied is a series of physical tests, added to which should be a guarantee in regard to efficiency in actual service; so that the question arises as to whether effective physical tests can be devised which will provide more information than the usual falling-weight test, and the tensile test.

The determination of the elastic limit might be more frequently applied, but, in any case, the limiting range, minimum and maximum, should be arrived at by engineers and manufacturers acting in conjunction.

For the elastic limit, breaking stress, elongation and contraction at point of fracture, more reliable results would be obtained if the test specimen were prepared from a special small ingot representing the cast from which the steel was to be rolled, while the falling-weight test could be used as a guide to the care taken at each stage of the processes of manufacture.

To give only one instance of the want of uniformity in composition, drillings taken from different parts of a single large ingot were found, on analysis, to vary in carbon content from 0·37 to 0·92 per cent., representing a variation in tensile strength of from 39 tons to about 95 tons per sq. in.; if this ingot were rolled into the form of a bar or rail it would still be made up of metal varying to the same extent, and while the representative test ingot might give 42 tons under test, drillings for analytical purposes would vary in composition as shown, although the rail might give a satisfactory *drop* test at any part of its length, providing a reasonable range for deflection had been decided upon.

It may safely be asserted that if, from the introduction of steel as a material for rail making and structural purposes, all tests and analyses had been carried out in independent test houses, the specifications now in vogue would never have existed, and if this question were thrashed out, the result would probably be of great advantage to both users and manufacturers of steel.

For such purposes as railway rails, bridges, axles, steam boilers, shipbuilding, tinplate manufacture, and all other instances where the quantities of metal required are sufficiently large to permit of the cost of chemical and physical tests being applied to determine the properties, and control the manufacture, steel of varying and special composition to suit each application can be taken full advantage of. Outside the range indicated, however, steel assumes a very different character, and the very fact that it is capable of being manufactured, either by accident or design, in qualities varying from the mildest to hard steel capable of tempering, and of being greatly affected by the treatment to which it is subjected in manufacture, instead of being an advantage to the users of small quantities, forms a serious obstacle to its employment.

As long as wrought, or malleable, iron was the only material available for use in engineering shops, its fairly constant quality rendered the determination of the proportions of the different parts of a structure a comparatively easy matter.

The writer, after a number of years in a large steel works, during which time he had become thoroughly acquainted with both the manufacture and properties of all the various classes of steel capable of being produced, having, in fact, been for some time chief of the chemical and testing departments, entered upon an appointment in an engineering works, and naturally expected that his extensive knowledge of the peculiarities of steel would be a considerable asset.

About the first thing to which this knowledge was applied was the preparation of specifications for the materials to be used in the manufacture of the firm's specialities—steel, wrought-iron, cast-iron, &c.—to enable quotations to be obtained and estimates to be prepared, &c.

In regard to wrought-iron, the manufacturers and merchants would none of them have anything to do with quoting on analysis; as for steel, though a large steel works was situated in the same town, they "could not quote for such small parcels," so that it became necessary to rely upon merchants. To make a long story short, the only class of steel, which any but important firms, controlling orders of a sufficiently large quantity of material to allow of the extra cost of selection, testing, &c., can make use of in a general way and with some confidence, is *mild steel*.

A System of Audible Signalling on Railways.

The paper by Mr. W. Dawson, read in Section I on the 20th inst., is a compressed statement of the need for supplementing the ordinary visual signals in use on railways, and includes a somewhat sketchy description of the form of apparatus now undergoing trial on the Great Western Railway.

The paper contains evidence of hasty compilation, and some of the statements made savour of special pleading. It is possible that the opinions expressed in the first two paragraphs of the paper will not meet with universal acceptance. In saying that the present system of visual signalling is satisfactory in clear weather, either by day or by night, the author seems to ignore altogether such occurrences as those of which the accident at Slough, some years ago, is typical; and when, in the same paragraph, he affirms the necessity for supplements during fogs, he, by implication, restricts the *usefulness* of such apparatus to exceptional atmospheric conditions. It is not necessary at this date to recapitulate here the reasons for considering such supplementary indications as being of the highest importance under all conditions, as they have been put forward in these columns on many occasions. To those who are acquainted with the limitations of human nature, the conditions under which railways are operated, and the disastrous results which have taken place —or have nearly taken place—from some slight deviation or inattention, it is unnecessary to restate the case for the usefulness of additional aids to the drivers of trains even under normal conditions.

In the second paragraph the author makes two important statements:—That railway officers and the inspecting officers of the Board of Trade are agreed that (*a*) any device which does not give a distinct audible "danger" signal, and a distinct audible "all right" signal, will not be satisfactory; and (*b*) that the devices must not depend upon electricity to give the "danger" signal.

It may, possibly, be news to many railway officers—particularly to those who may be engaged in this class of work—to hear that they have subscribed to these opinions; and considering the well-known and highly commendable caution of the Board of Trade inspecting officers in committing themselves to expressions of opinion on abstract subjects, it is possible that the statements may be news to those gentlemen also. Audible signals for either "on" or "off" indications are no novelty, as anyone acquainted with proposals and accomplishments is well aware. As a means of calling attention they are excellent, but once they are

stopped, they leave no indication for verification, and the driver's memory and knowledge of the situation must be relied upon in the journey towards the "stop" signal. The true function of the audible signal is to call attention to the real indication for the position of the signal to which approach is being made. If the line distant signal (in being) is being indicated, the audible indication should be given before the line signal is reached. In such a position it acts as a warning of locality, and if a standard distance is established the driver knows between what limits he must specially look for the line signal. Under such circumstances his attention is forcibly called to the fact that he is approaching a signalling point where he should be on the alert. If the line distant signal has been dispensed with, the signal to be indicated to the driver is the first stop signal—the Home. In any and every case it is desirable that a permanent indication of the last indication received should be retained.

Probably the most surprising statement in the paper is that in which we are told that electricity should not be the medium through which the "danger" signal should be given. Looking at the commendation given to the system employed by the Great Western in a paper in which this statement is made, it might be thought that electricity played no part in giving that indication, and the impression would certainly be confirmed by the wording of the third paragraph on page 2 describing the operations by which the "danger" signal is given. Reading this paragraph without further knowledge would indicate that "the lifting of this rod opens a small steam whistle fixed in the cab of the engine" directly. As a matter of fact, the mechanical motion merely opens a small switch in a normally closed electric circuit, and the opening of the circuit liberates the armature of an electromagnet which controls the valves of the steam whistle. Why should there be so much distrust of a medium which is used in a system which the paper commends so highly for giving the "danger" signal? Electricity, moreover, is used to give the "off" signal, and who will undertake to define in what degree that signal is less important to the efficient working of a railway than the "on" signal? How long could any system hope to keep its place if it could not be depended upon to transmit the "off" indication to the drivers of trains? How long would any railway company submit to the inevitable delays to traffic that would result from missing the "off" indications? With the highly organised, fast-running traffic, making connections for diversions to every part of the country, and depending essentially upon punctuality, running to booked time is imperatively necessary. No railway company could, or would, put up with delays introduced from causes such as seem to be the bases of the distrust exhibited in the paper. Advocates of electrical transmission might point out that, in the system advocated, it would seem possible for breakage of the lifting mechanism to take place in such a way as to prevent operation of the switch, and for proof of breakage of even considerable masses of metal under similar circumstances of use, they could point to actual occurrences. They could also point out that the more powerful the control acting upon the striking part, the greater the stress sustained thereby, when the other party to the impact is rigid. The blows sustained are very severe. A train running at 70 miles per hour passes over 111 ft. per second. The effective time of contact cannot therefore be more than half a second, and with a curved bar may not be more than one-third of a second. In that time the shoe has to be raised, and the arrangements must necessarily be such as to prevent the energy of the movement taken up from being transmitted to the switch. A powerful control is, therefore, necessary, and the blow sustained by the shoe, or contact-making device, is necessarily increased, and the chance of breakage multiplied accordingly. The Great Western system, in so far as contact is concerned, is designed on lines which have been recognised for some time as liable to failure under numerous great stresses, and abandoned accordingly. Experiments on the North-Eastern Railway, which have been carried on for about 18 months with apparatus of a different character, have not had such results as to engender suspicion of the reliability of electrical action of the character indicated in the paper. Excellent results were obtained when the contact bars were almost buried in snow, and when their surfaces were covered with frozen snow.

The paper leaves a good deal to be inferred as to the direction in which other requirements in connection with railway signalling are provided for. For trains approaching junctions it is imperative that the driver of a fast train should know that the proper line has been prepared for him to go forward. If the wrong road has been prepared, and he is turned sharply to one side, the conditions which actually caused the accident at Grantham will be repeated.

It is also desirable for good reasons that the signalman should know that the apparatus under his care are in good working order and giving the signals which he expects them to be giving. Much time may be unnecessarily lost by the driver getting a "danger" signal at the distant signalling point, and crawling to the home signal prepared to stop, to find that the "all right" signal had been given by the signalman immediately after he had passed the distant signalling point.

The Great Western Co.'s system is ingenious, and shows good work up to the point to which it has been carried; but if, as stated by its advocate, there were something required from such apparatus which electricity could not be relied upon to perform effectively, the conclusion would be forced upon us that railways would be better without it, seeing that electricity plays the principal part in every operation. Our opinion, however, is the exact opposite. There seems to be no reason why electricity should not do everything that may be required, given careful design of apparatus, such margins as are required in all engineering work, and the maintenance that such apparatus is entitled to. Without these essentials no system can be successful.

Electrical Pumping.

The short paper read in Section VI. (Waterworks, Sewerage and Gasworks) on Wednesday by Mr. Charles Hawksley and Mr. Henry Davey upon the "Comparative Cost of Pumping by Steam, Internal-Combustion Engines, and Electricity, based upon Actual Working," is not too short to include a severe attack upon electricity as a motive power in pumping. Indeed, the paper may be said to be nothing else but a severe though superficial attack. The paper, judged superficially by one not acquainted with electricity, would lead to the conclusion that the attack was well founded. However, fair bases of comparison have not been taken. Every electrical engineer would at once concede that if he were given the problem of pumping at some waterworks with an absolutely steady load, he would put down a steam pump instead of an engine, dynamo, and geared pump driven by a motor, and would agree that the conversion losses and capital outlay which would be incurred in the latter case would not be sound engineering. But every electrical engineer would strongly demur to the broad statement advanced by the authors that "electric pumping plant cannot be economical in fuel, as compared with steam pumping engines of moderate economy."

That electrical pumping from a power supply station is an economical practice is well established by recent experience on the north-east coast for pontoon and dock pumping, where demands are irregular and the stand-by losses of separate boilers prohibitive. In colliery work also the high-lift motor-driven centrifugal pump possesses an economy and an adaptability which steam-driven pumps cannot conceivably equal.

Such papers as the one before us should really induce central station engineers to retaliate upon the generalities of Mr. Hawksley and Mr. Davey by adventuring upon the field of pumping. Sewage works are a case in point. There the heavy dry-weather day flow takes place during times of light loads at the central station, and the flow during the evening peak is quite small. Further, the storm-water flow can be tackled more economically by obtaining power from the generating station than by maintaining stand-by engines and boilers at the sewage works. Borough electrical engineers seeking to improve their works load factor should set about the conversion of the borough civil engineers, and get their motors installed for the purpose of driving pumps when sewage works are extended or are re-modelled.

CORRESPONDENCE.

Letters received by us after **5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Electrical Trade.

I have read with great interest the trenchant article by "Agnostic" on the present state of the electrical industry, and am in agreement with him on most points. While recognising that it is, in the main, a brief for the electrical contractor, one cannot but admit that the writer's remarks are, mostly, but too well justified. The control exercised by consulting engineers, either openly or covertly, is little short of a scandal, and in the senior branch of engineering would not be tolerated. When one sees specifications drawn up obviously with a view to favouring particular manufactures, one cannot wonder at the petty malpractices of those lower in the professional scale than the trusted consultant. The case of the manufacturer, fighting in the last trench, so to speak, by working for no profit, is easier to understand, and except for the fact that he often eliminates the contractor by treating with the user directly, he is not to be blamed by any but those unfortunates who have money in his concern and the equally deluded professional men who have taken service with him, thinking that loyal work would mean security of tenure.

Municipal trading in our industry has never become very serious except in one large town, chiefly by reason of the want of Parliamentary powers. In this connection it must be admitted that where the local contractors are worth their salt, there is no hankering after such powers on the part of a sensible supply engineer.

It should not be forgotten in connection with low prices for contracting work, that a certain contracting company, which has undergone almost as many changes as a chameleon, was largely instrumental in bringing these down to an unprofitable level in many towns.

Most of the unprofitable business is done with other people's money. *Verbum sap.*

Where I am at issue with your contributor is in his remark that Preference would not do the trade good. I think I can show the fallacy of this from his own article.

How are the manufacturers to raise prices and keep them up when they are subjected to unfair competition from abroad? Because, in spite of the implication contained in "Agnostic's" remarks on this point, the foreigners do send us some good stuff in all lines, and what is more, a lot of this finds a permanent home here on a price basis. We are not pre-eminent in everything, and I do not suppose that "Agnostic" is unaware that such is the case. It is only that he has changed his point of view from the general to the particular at this stage, and he concludes that protection would not make much difference to the contractor, as such.

With regard to the dictum that municipal engineers are rarely business men, I may say that I know the majority of them and do not agree with him. In many cases their business aptitude has no chance of developing, owing to the cast-iron *régime* imposed on them by their quasi superiors. In some directions they do show a want of the proper commercial spirit, notably in failing to offer lighting during the daylight hours at somewhere near the price of energy for power.

Ubique.

The further correspondence published this week is interesting and calls for some reply.

"Fair Play" writes in defence of the consulting engineer and refers to the instance given in my letter, where there was no consultant employed. Allow me to give two out of many other instances in South Wales where a consulting engineer was employed.

In one case ten firms tendered for an electrical equipment, and the prices varied between £2,050 and £3,150 for the same job, to specification. The lowest tender was accepted, and the firm, although a good one, will certainly lose £500 on it, and it remains to be seen how they will carry out the work.

In another instance, for a motor equipment, eight firms tendered at prices between £330 and £650. Again the lowest tender was accepted, and by a firm with a good reputation. It is now 11 months ago, and the order has not yet been satisfactorily executed. In fact, the firm have now written to say that it will cost them £500 odd to carry out the contract, in addition to the cost to date, and they ask the engineers to give them this extra price! This is evidence that a consulting engineer, with all his powers, cannot prevent a contractor from committing suicide.

Verily, they are all fools, the buyer for accepting a tender at a price, which he must know is absurd; the contractor for accepting an order at a loss; and the engineer for allowing such a suicidal policy, which must reflect on his reputation. I repeat, the electrical trade in South Wales is like unto an intoxicated youth staggering with uncertain steps to an unknown destination! Take three sodas, my boy, and go to bed, and on the morrow, go out and watch the manly strides of your more temperate cousin the motor-car industry. In the meantime, it is no use arguing with you; *you are drunk.*

An Interested Spectator.

I had hoped that some abler pen would have replied to, or entered a protest against, the remarks of your contributor, "Agnostic," on the subject of Protection.

I dislike having my technical reading mixed up with politics, but if it has to be so, let the politics be supplied by someone who "knows," and not by an "Agnostic," as your contributor somewhat unfortunately, but, as regards politics, apparently correctly, calls himself.

He, however, convicts himself in his letter, when he draws attention to the organisation of the cable makers as an example to be followed.

If he will refer to your issue of May 31st, page 901, he will see that during April we exported £43,042 worth of cable to the different foreign countries, but we imported from Germany alone £42,543, or only £500 less than our total exports, and the total imports of cable amounted to £61,765.

It so happens that this is the highest import figure in your list, and it applies to what, I believe, your contributor is correct in saying is the best organised section of our industry.

M. J. E. T.

Wolverhampton.

CORRECTION.—In the letter of "Believer" on "The Electrical Trade" on page 953, last line but one, first column, a small but important error occurred. For "*electrified* factories" read "*non-electrified* factories."—EDS. E.R.]

Careless Workmanship.

As manufacturers of electrical accessories, we note, with regret, that a matter showing considerable want of thought amongst contractors, art metal workers, platers, &c., is now greatly on the increase.

We refer to the treatment electrical accessories receive when any special bronzing has to be matched, or plating work done, more particularly in regard to switches, wall connections, &c., and think it is about time some protest was made, as otherwise decent workmanship and materials become spoilt.

It appears that when plating or any special finish is required, the whole article is plunged into the cleaning, plating, or bronzing bath, as the case may be, without thought as to the ultimate result, instead of separately treating the parts before they are assembled.

These hot, corrosive, acid and alkali solutions remove the protecting coat of tin from steel springs and produce rust, creep under terminals, contact springs, and between insulated surfaces, &c., the ultimate result being verdigris or oxide, which produce a rotting of the parts, resistance, heating, and consequent breakdown of insulation, besides rendering the user liable to shock; in addition to these defects, the articles present a very dilapidated appearance, discrediting those who

are in no way responsible for their inefficient finished condition. The client pays an extra price for a special "finish," but it is obvious that he obtains instead an inferior article where such methods are in practice, and we cannot think that architects, consulting engineers, or their clients, are aware of the prevalence of this haphazard method of carrying out their instructions when dealing with what would otherwise be decent material. We would respectfully suggest that a closer inspection be made of the metal parts of finished goods, when such slipshod work would be quickly brought to light and the blame placed in the right quarter.

A. P. Lundberg & Sons.

London, *June 11th*, 1907.

Electrically-Driven Cement Works.

Referring to the article published in your issue of May 17th, *re* the above, allow me to call your attention to a slight misstatement which appears therein, namely, "that this is the first cement plant in this country to be electrically driven throughout." It may interest your readers to know that in 1900, Messrs. Mather & Platt, Ltd., of Salford Iron Works, Manchester, supplied the complete electrical plant for driving a large cement works at Swanscombe, which is now controlled by the Associated Portland Cement Manufacturers. At a time when so much is heard in the Press regarding the backwardness of the British manufacturers, I think this should help to show that Englishmen are quite capable of, and do successfully compete with foreigners, although they do not continually call attention to it in the Press. I understand that this firm with whom, until recently, I have had the honour to be connected, have gone a step further and beaten the Americans "on their own ground," by securing, against the latter's very close competition, a repeat order from the Montreal Water and Power Co. for a motor-driven centrifugal pump, capable of delivering 10,500 gallons of water per minute against a total head of 375 ft. The motor of this set is of the three-phase type, capable of developing 1,800 B.H.P., when working from a 2,200-volt 60-cycle circuit. Both motor and pump are being constructed at Manchester.

Frank P. Spicer.

London, E.C., *June 12th*, 1907.

[We are aware that many cement works in this country are largely electrically-driven, but *electrical driving throughout* appeared to us to be a novelty. Strange to say, British manufacturers as a rule not only do not continually call attention to their achievements, but are apt to show a reticence regarding them which presents a sharp constrast to the attitude of their foreign rivals. Whether the American or the British policy pays best is obvious from the results. Regarding Canadian trade, the fact that Americans regard it as their own ground is only too sadly true; our manufacturers, instead of crowing over an occasional scrap from the feast, ought to secure the bulk of the trade.—EDS. E.R.]

How to Buy a Motor.

I was both amused and interested by the article by Mr. Ben Frank, appearing in your issue of the 7th inst., which claims to be "based on facts." In this the writer says: "I don't usually see travellers," and herein to my mind lies the moral of the whole story.

It does not appear quite clear whether Mr. Ben Frank is an electrical contractor or otherwise, but apparently he is not, though he got a discount! Still, why not see travellers? or depute some qualified person to do so.

Manufacturing firms cannot always keep the trade consumers conversant as to what they are doing by means of silly letters and circulars, moreover as these generally go straight to the waste paper basket there is little use in sending them. Money is better spent by employing a "traveller"—who as often as not is a thoroughly qualified and experienced engineer—for the purpose. If the heads of firms will not see these gentleman, they cannot expect to be *au fait* as to what is going on, or as to how their needs might be met. Space will not allow of the matter being fully dealt with here, but it is to be hoped that Mr. Ben Frank and others will profit by the moral, and, in future, see travellers, or some of them, and thereby do unto others as they would be done to. A little time so spent will be well repaid.

Notone.

Wiring Cost of Small Houses.

The members of the West Ham Electrical Contractors' Association have read with some interest, not to say amusement, the correspondence of the past few weeks in your valuable journal. I am instructed to reply as follows:—It may surprise your readers to learn that while Mr. Seabrook professes that the contractors are not "hampered in any way" by the electrical department of the borough, it has been the unfortunate experience of most of them to lose orders wholly through the department, for as was stated by a consumer to a contractor who applied for orders for metallic filament lamps, "I have only to grumble enough and I can get them for nothing." This, after Mr. Seabrook has promised the contractors not to sell lamps at all.

The Corporation are also supplying arc lamps, carbons, and executing repairs for consumers, to say nothing of many instances where the department has actually taken work from the contractors and executed it themselves at a figure so low that no contractor, however "cutting," could possibly compete. How can the engineer to the Corporation say that he is "helping the contractors," being cognizant of these facts? Surely, it cannot be that he means he is helping them to find work in other boroughs where there are regulations and restrictions.

Edw. W. Jackson,
Hon. Sec., West Ham Electrical Contractors' Association.

London, E., *June 17th*, 1907.

Making Calcium Carbide in Ireland.

The editorial comment on this matter, was that probably some of their readers knew of sites where 100 H.P. could be had in Ireland. I am prepared to guarantee that within three months I will find at least 100 sites where 100 H.P., and over, can be obtained in Ireland; also that cost of harnessing same shall not exceed £7 12s. 6d. per horse-power obtained. This can be even more easily accomplished in Scotland, though almost impossible to accomplish in England.

Remarkable to say, a few years ago I had the option of a 500-H.P. site for £50 per annum—this works out at just 2s. the horse-power. This site is almost ideal in many respects; first of all it can be harnessed, weir, power house and turbines inclusive, for £5 the horse-power, therefore, rent, interest on capital and cost of up-keep would be well under £1 the H.P.-year. This site, which is now on the point of being acquired for the making of calcium carbide, is, I say, almost ideal, being but a few miles from Manchester, and in direct touch with sea-going vessels. Buxton lime, 99 per cent. Ca., and I believe, the best in the world for the purpose, can be delivered on the premises at 12s. per ton.

I have data to show that it is quite possible to manufacture calcium carbide, under these conditions, at £5 per ton, probably below. Your querist would, I think, be wise in joining us, unity is strength; 100 H.P. is certainly too small to produce calcium carbide commercially.

W. Antrobus.

Manchester, *June 11th*, 1907.

P.S.—See my letter, ELECTRICAL REVIEW, May 10th, page 760.

[Our comment was not that which is stated above; we said there were large water-powers available in Ireland, and that perhaps some of our readers knew of electrochemical processes which could be carried on with as little as 100 H.P. —EDS. E.R.]

The Literary Engineer.

In the issue of THE ELECTRICAL REVIEW of May 31st, you printed a very interesting article upon the above subject, by "A University Lecturer," in which the writer of the article declaimed somewhat strongly against some of the writing upon engineering subjects that is turned out at the

present day. With a great deal of what the writer of the article says, I am in hearty agreement. Long, involved sentences, are certainly very much to be deprecated, and mixed metaphors are undoubtedly very misleading. But is not the striving after purity in grammar in engineering literature being carried somewhat too far, in many instances?

I venture to say that if any *littérateur* ever stated that writings upon engineering subjects were not literature, he stated absolute nonsense. It would be as reasonable to say that the Egyptian hieroglyphics were not literature, or the cuneiform inscriptions on the tablets of Babylon. Is it not possible to spend so much time upon writing pure English, correct grammar, when describing engineering apparatus, or discussing engineering problems, that the time available for thinking out the problems themselves, or the structural details of the apparatus is so small, that the writing is worthless from a practical point of view? Though all of us who write on engineering subjects, I take it, are anxious that our writing shall be as grammatical, and as good English as we can make it, we are too much occupied in studying the laws of nature, as they are being unfolded day by day, to spend much time upon a very careful study, or a very close attention to the laws of grammar.

If it be a question, too, of either engineering literature as it is going to the wall, or of grammar going there, I venture to say that the world can do without grammar a hundred times better than it can do without engineering literature, even at its worst, from the grammatical point of view.

In my experience, also, I have found that those who are such purists in the matter of grammar are not much good for anything else, except in very special cases. A knowledge, sometimes an assumed knowledge, of grammar is often employed to hide crass ignorance of the subject the eminent grammarian is discussing.

It has appeared to me also that the grammatical purist is nearly always a terribly ill-natured man. He appears in the great majority of cases to cultivate the quality we are rather apt to associate with a large number of the opposite sex, of making themselves disagreeable to everybody. The grammatical purist appears, in too many instances, to revel in saying nasty things. I would like to remind him that the object of engineering is the betterment of the condition of the world generally and of the men and women in the world, and that ill-natured comments upon what are often important contributions to engineering literature bring nothing to the betterment of the world, and, if anything, retard its progress.

Sydney F. Walker.

Bath, *June 17th*, 1907.

[We regret to say that we are not at one with our correspondent as regards the importance of literary ability. Anyone who cannot write reasonably good English *ipso facto* shows a lack of general culture, from which the natural and usually correct inference is that his views will be found to be narrow and his opinions of little weight. There are, of course, exceptions to this, as to most general statements. But certainly one who has to spend the bulk of his time upon the form, rather than the substance, of his literary productions is quite unfitted to write. As for Mr. Walker's last paragraph, we side with the angels, and warmly repudiate his ungallant aspersions!—Eds. E.R.]

Broite.—A correspondent asks the name of the maker of the temporary lighting arrangement called "Broite."

Electric Plant for Refuse Works.—The new electric plant supplied by the Southwark Engineering Works for the treatment of house refuse has been tested at the Manor Place depôt of the Southwark Borough Council. The new machinery is known by the name of the "lightning dust manipulator," and it is claimed that it solves the question of the disposal of refuse in a sanitary and economical manner. The machine is constructed on the principle of the sausage machine, but on a more extensive scale. All the refuse goes in at one end, and comes out at the other in the form of minced refuse, having the appearance of a black mould. The material is very valuable as a fertilising manure. There is a contrivance by which any pieces of steel, iron, or other substance, incapable of being pulverised, are automatically thrown out. The transformation of the house refuse to manure is almost instantaneous.

LONDON'S ELECTRICITY SUPPLY.

By ONLOOKER.

An electoral mandate would seem to be possessed of peculiar and perplexing attributes. Eagerly fought for by parties combatant for administrative authority—whether national or local—no sooner does the successful faction joyfully acclaim success, than the possession of this instruction of the people appears in some baleful and mysterious way to paralyse their legislative efforts either in the initial process of conception or the later stage of achievement.

Now, the London County Council when a "Progressive" body had no "mandate" to pledge the financial credit of London in the promotion of their bulk and power supply scheme. Such mandatory powers as they originally possessed had long been exhausted by their Gargantuan labours in brick-making, running an expensive and unnecessary steamboat service up and down the river, and in the encouragement of socialistic propaganda, and so on. And it accordingly happened that if their courage last year had but equalled their desire, and they had boldly asked then for the powers sought by the Bill presented in February of this year, such powers would probably have been granted to them.

The Council as *now* constituted have a most emphatic mandate not to embark upon the electric supply undertaking, but to do all they can to assist in its development by private enterprise, whilst themselves obtaining and exercising all necessary powers for the control of the prices and conditions of supply and other safeguards of the consumer. The Moderate or Reform Party have not long been in power, but already the insidious "mandatory paralysis" is incipient in the region of electric supply, and bids fair ere long to develop the must aggravated symptoms. In fine, to mix the metaphor a bit, the conceptive efforts of the Moderates are in danger of proving as abortive in Parliament as those of their predecessors. This is much to be regretted, for the Bill, as amended to meet the Moderates' policy, formulates a scheme which, generally speaking, is on businesslike and practical lines.

Of course, the dominant party on the present Council took office committed by definite electoral pledges to lease the executive portion of any powers obtained in relation to electric supply, and the principal proposals of the Bill involved in such a transfer would presumably be those of:—

Sec. 26.—As to purchase of lands at Barking and Erith with the powers of the usual character as to erection of power stations and generation and transmission of energy.

Sec. 10.—As to supply of electricity over an area embracing the County of London and certain adjoining districts and extending, roughly, from Enfield and Waltham Holy Cross on the north to Croydon in the south, and from Richmond on the west to West Tilbury in the east, to authorised undertakers and to any person requiring a supply for power under the terms of what is known as the "Kitson" Clause.

Secs. 11 and 12.—As to obligations to supply, and the contingent clauses as to conditions of obligatory supply and penalty for default.

Sec. 15.—As to maximum prices.

Sec. 17.—As to supply to authorised distributors or railways, tramways, canals, navigation docks, or waterworks, whose undertaking is situate partly within and partly without area of supply, for use in part outside such area.

Sec. 22.—As to the giving and taking of a supply of energy in bulk to or from any undertaker authorised to supply in any area contiguous to the Council's area of supply.

Sec. 23.—As to the taking of energy from any authorised distributor in the Council's area of supply for use in any part of such area.

Sec. 49.—As to purchase, by agreement, and subject to approval of B. of T., of the whole or part of the undertaking of any of the scheduled distributors, subject as in such Clause provided.

Sect. 65.—As to the supply of electrical fittings.

Sec. 21.—As to the obtaining of provisional orders for any district in the supply area where no supply, or supply for certain purposes, only exists.

Sec. 52.—As to taking over and working of any order or Act authorising supply in Council's area of supply, the powers of which have not been exercised.

In transferring their powers, two courses would seem to have been open to the Council, viz., either—

(*a*) To transfer the whole of these powers to (1) a new company possessed of the necessary financial means; (2) to the Joint Committee

which by their Bill the London Electric Companies seek to create; or (3) to the North Metropolitan Electric Light and Power Co. under Clause 10 of their Bill (unless this Clause has been deleted from the filled up Bill) for a term of years for a suitable consideration, and subject to the Council's contract as to prices and conditions of supply, or

(*b*) To transfer such powers to the said Joint Committee, excluding the powers of Section 26 and providing instead that the companies might re-equip, extend and otherwise develop and link up, by duplicate high tension mains, a number of their stations most suitable for the purpose of supplying energy in bulk and for power throughout the area of supply. The stations converted for bulk supply and the high tension transmission system to become subject to purchase as part of the undertaking, but not, of course, the distributing systems.

In both cases serious difficulties arise. The heavy increase in capital expenditure (as compared with last year) provided for in the original Bill, makes it clear that the Council's technical advisers had accepted as justified some of the main criticisms of their previous scheme, which was attacked on the ground of inadequate provision for

1. The generation and supply of energy;
2. Alternate routes of high tension transmission; and
3. That the proposed generating station was to be situated in the London area.

Accordingly, their recommendations this year include a generating station (the second would not be likely to be required for many years hence), of much larger capacity than they previously thought necessary and great additional expenditure on the transmission system, occasioned in part by the station being situate so far down the river, and in part by the provision of additional mains.

Now, in the case of arrangement (*a*), the whole of this expenditure would devolve upon the lessee, and would not, in all probability, fall far, if at all, short of the estimates of the Council's engineers. As to what these estimates are, the only guide is the provision made in the original Bill, for, at the time these lines are written, no technical witness has been in the chair, and no figures are available.

As an argument against the exercise by the Council of the proposed powers, it has always been urged that the bulk and power supply business, particularly in its initial stages, must be of an extremely speculative character, and even its advocates have admitted that only the adoption of the most modern methods of commercial enterprise can eliminate this risk. It is, therefore, readily apparent that before embarking huge sums in an enterprise of this description, a lessee will require to be assured an undisturbed possession of the transferred powers for such a period as will afford a reasonable opportunity of properly developing the business and obtaining a fair return for capital outlay, particularly having regard to the fact that the terms of purchase do not allow of any compensation for loss of profits. Indeed, it is practically certain that no lessee would incur such abnormal expenditure under a lease for a period less than 40 to 50 years. As the matter stands (see new clause 66A), the Council propose to transfer their powers for the latter term, but in doing so they have to face the difficulty, that whereas it is in many ways desirable that the reversion to municipal ownership of both the bulk supply and distributing undertakings, now owned by companies, should synchronise, the fact that the latter become purchaseable as early as 1931, renders it impossible to negotiate a transfer of the bulk supply powers by a lease to expire at the same date. The only other way under arrangement (*a*) to secure simultaneous ownership would be to postpone the purchase of the distribution undertakings so that it would fall upon the same date as that of the bulk supply undertaking. The Bill, however, contains no proposal of this kind, nor would Parliament be likely to sanction such an arrangement, although, in spirit, it would not be altogether contrary to the recommendation of last year's Select Committee as to the creation of "one large and comprehensive scheme." The adoption of arrangement (*b*) might, it is conceivable, have obviated this difficulty, for the capital outlay involved would be very much less, and it might, therefore, not unreasonably, be supposed that the companies might be induced to take a lease of the Council's powers expiring in 1931, but in such case the Council would have to accept a far smaller consideration than in the case of the larger concession. It must, however, be remembered that whilst both the local authorities and companies (possessing, be it noted, all the actual experience of electric supply in London), have always urged that they have done everything possible to encourage the use of energy for industrial purposes, the results achieved by the offer of the most favourable terms do not warrant the supposition that any demand exists which they cannot in every way adequately provide for, and that the linking up and development of certain existing stations would enable them to do all which the promoters of power Bills propose to do, and to do it as well and as cheaply. On the other hand the power company folks (who have no actual experience of supply in London), say that if the *potential* demand for power for industrial and other purposes was turned into an actual one, as it should be, the total of such demand united to that for lighting purposes would be of such volume that no possible development of existing stations would enable existing undertakers to adequately supply it with reliability and on reasonable terms. This view was strongly held by the Council's technical witnesses last Session, and the lines of their present Bill again commit them to the same principle, so that, in order to adopt arrangement (*b*), the Council would have had to throw over not only one of the principal arguments put forward in support of Power Bills for London, but also the advice of their technical advisers. Further than this, the Select Committee last year were clearly in favour of a scheme for bulk and power supply, and to put forward arrangement (*b*) would have been tantamount to asking Parliament to stultify to a considerable extent the recommendations of that Committee.

In adopting arrangement (*a*) the Council appear to have followed the line of least resistance, but even then it must be confessed that the outlook for any practical results this Session is not very hopeful. From what transpired on Friday last (these words are written on Monday, the 17th June), it is evident that the Bill will only be passed this year subject either to the forms of lease being settled before the Committee and scheduled to the Bill, or to any arrangement as to leasing made by the Council being submitted to Parliament for approval. Under these circumstances, it would seem regrettable that the Bill should provide for the powers to lapse if a transfer is not arranged within 12 months from the passing of the Act, for if, as is possible and indeed very probable, such a lease as the Committee would require embodied in the Bill would not meet the views of those in a position to acquire and execute them, all the latter need do is to wait until the Council's powers so lapsed and then promote their own power Bills, getting rid of the Council's opposition by conceding control of prices and conditions of supply and the ultimate right of purchase. It will be a thousand pities if a settlement is further delayed, for the time is ripe and the parties are in propitious mood. But whilst accomplishment may be hoped for, delay is to be feared.

THE LOWEST TENDER.

[BY OUR LEGAL CONTRIBUTOR.]

Persons who are concerned with entering into contracts with local authorities are often put to the trouble and expense of tendering, only to find that their labour is in vain. The advertisement for tenders usually makes express mention of the fact that the "Council (or other authority) do not undertake to accept the lowest or any tender"; and, in view of this fact, the contractor has no just cause for complaint. He enters upon the transaction with his eyes open to the risks which he may have to run. But there is a large body of persons which takes a keen interest in the contracts of a local authority. We refer to the ratepayers. It is a matter of considerable importance to them that the lowest tender shall, as a general rule, be accepted. Of course, if the local authority have doubts as to the financial stability of the contractor whose tender happens to be the lowest, it might not be wise, in the interest of the ratepayers to accept his tender. But it is only too often apparent that local and political considerations are often allowed to affect the decision of the question as to which tender shall be accepted. The result is unfair to the contractors tendering, and may well be unjust to the ratepayers. The interesting question is—Have the ratepayers any redress?

A recent case in the Divisional Court throws a certain amount of light upon this question. We refer to the King *v.* Roberts, which was heard by Lord Alverstone, C.J., and Darling and Phillimore, J.J., on April 30th. A district auditor, acting under powers conferred upon him by Sec. 247 of the Public Health Act, 1875,

disallowed and surcharged certain payments made by the Finance Committee of a local authority for shingle, and by the Highways Committee in respect of a contract for the supply of certain goods, upon the grounds that the shingle as delivered by the contractors must have been short in weight, the deliveries not having been, in his opinion, properly checked, and that the tender for the supply of the goods which was accepted was not the lowest tender. The auditor disallowed the amount which he estimated as the loss to the ratepayers therefrom. Upon an application to set aside the surcharge, the Divisional Court held, in effect, that the disallowance as to the contract was wrong, inasmuch as the Highways Committee had *bonâ fide* come to the conclusion that the tender was the most advantageous one. The following passage in the judgment of the Lord Chief Justice appears to be of great importance. He said: "While the duties of an auditor under the Public Health Act are much more important than those of the auditor of a company, he is not entitled to question the judgment of honest men who have come to a *bonâ fide* decision on these matters. Perhaps there is no better illustration of that than in the acceptance of tenders. Anyone with knowledge of these matters knows that the greatest mischief sometimes comes about by the acceptance of the lowest tender; and in my opinion it would be most dangerous to say that, given honest members of the Committee (against whose character or position in the present instance not a word has been said), simply because they have not accepted the lowest tender, that was *primâ facie* evidence that they had not discharged their duty. I can well imagine that there might be the acceptance of a higher tender in circumstances which would give rise to suspicion of corruption or want of good faith; but for an auditor to assume the responsibility of saying that tenders ought not to be accepted, and that others ought to be accepted, because, on a hypothetical calculation, the Council would save so much, would open the door to a most dangerous practice. The auditor was not entitled to treat the statement of the Committee that they accepted a particular tender believing it to be the best they could do, as of no account, and I decline to assent to the view that an auditor, with nothing else before him beyond the fact that the lowest tender was not accepted can treat that as evidence of misconduct or negligence."

So far as we are aware, this is the first case in which this all-important question has been presented in concrete form for the decision of an English Court; and while we do not doubt that the conclusion to which the Court has come is right in law, we can only say that it is extremely unfortunate.

Why should any considerations other than those of efficiency and economy be allowed to affect the judgment of a Borough Council or other local authority in deciding, What tender shall be accepted? The only consideration which can possibly lead a local authority to accept any but the lowest tender must be that, by accepting a higher tender, some indirect benefit will accrue to the district. We omit, of course, the case of a tender being refused on the ground that the financial stability of the contractor is open to question. Such a ground of refusal would satisfy everyone. Thus it may well be considered that in giving the job to a particular contractor, the local authority will secure the employment of workmen who live in their district. That, no doubt, is very laudable; but it is not every local authority which is appointed to administer charity or grant relief out of the rates. If there is lack of employment in the district, and consequent distress, these are matters for the Poor Law Guardians to take into consideration.

Anyone who is conversant with the views of the electrical world upon these important questions, must of necessity feel somewhat keenly upon this matter.

Let us take a concrete case. A Borough Council decides to lay down a complete electrical installation, and it is left to a Committee to arrange for the contract, to invite tenders, and to decide which contractor shall do the work.

Presumably the Electrical Committee of the Council will have upon it some members at least who are competent to decide as to the merits of the various contractors who accept the invitation to tender; but those who have expert knowledge may be overborne by the numbers of those who are influenced by entirely different considerations. In the result the contract goes to some firm whose work may be excellent in its way, but whose success has been due to political considerations. The conduct of business on these lines is undesirable for many reasons. It is a denial of the principle of fair and open competition; it tends to introduce all kinds of sordid intrigue into the allocation of public contracts; and last, but not least, it is contrary to the interests of the ratepayers who must inevitably lose in the long run.

In conclusion, then, while we do not anticipate that Lord Alverstone's judgment can be impeached as being erroneous in point of law, we trust that the Legislature may take the matter in hand, and remedy what appears to us to be a serious defect in the law of local government.

A Scientific Exhibition.—An exhibition of engineering models, optical, electrical and scientific instruments, technical education appliances, and tools, is to be held at the Royal Horticultural Hall, Vincent Square, Westminster, S.W., from October 22nd to 26th inclusive. In addition to exhibits by the leading makers of the above-named goods, there will be an important loan collection of interesting experimental and exhibition models and apparatus, and also lectures and demonstrations in various branches of applied science. The exhibition is being organised by Messrs. Percival Marshall & Co., 26-29, Poppin's Court, Fleet Street, London, E.C., who will be pleased to give further particulars on application.

PARLIAMENTARY.

London County Council Electric Supply Bill.

Wednesday, June 12th.

The Electric Supply Bill promoted by the London County Council came on Wednesday, June 12th, before a Select Committee of the House of Lords, presided over by Mr. D. A. Thomas. The Council were represented by Mr. Freeman, K.C, Mr. L. Coward, K.C., and Mr. Clode, and petitions against the Bill were presented by the Willesden U.D.C., Leyton U.D.C., Gravesend Corporation, Ealing Corporation, Surrey Commercial Dock Co., Battersea Borough Council, Great Central and other railways, Camberwell Borough Council, Kent County Council, Southwark Borough Council, Bexley U.D.C., Bromley R.D.C., London and Tilbury Railway, East Ham Corporation, Twickenham U.D.C., Barnes U.D.C., West Ham Corporation, Walthamstow U.D.C., Islington Borough Council, Beckenham U.D.C., Dartford U.D.C., Commissioners of Sewers, South Essex Water Co., Crompton's Electric Supply Corporation, Hornsey Corporation, Middlesex County Council, Dartford Gas Co., Dartford R.D.C., Teddington U.D.C., owners of property in the area of supply, Hackney Borough Council, Fulham Borough Council, Kent Electric Power Co., South Metropolitan Electric Tramways, North Metropolitan Electric Supply Co., Croydon Gas Co., Thames Conservancy, Brentford Gas Co., Whitechapel and Bow Railway, West Kent Gas Co., companies supplying electrical energy in the neighbourhood of the county, Gas Light and Coke Co., South Metropolitan Gas Co., Commercial Gas Co., Tottenham U.D.C., Corporation of London, Grays Gas Co., Croydon R.D.C., Finchley U.D.C., Wood Green U.D.C., Metropolitan Water Board, London United Tramways Co., Greenwich Borough Council, Westminster City Council, Bromley Corporation, Hampstead Borough Council, Kingston-on-Thames Corporation, Malden and Combe U.D.C., Marylebone Borough Council, St. Pancras Borough Council, Shoreditch Borough Council, and the Woolwich Borough Council.

Mr. Freeman, K.C., in opening the case for the promoters, said that it was a matter of almost national importance that the question of the electric power to be supplied to the Metropolis should, if possible, be settled on some satisfactory basis at once. There were now 16 local authorities which had obtained electric lighting orders and 13 companies, and the capital of the companies and the local authorities expended on electrical plant was £19,000,000 in round figures. In 1898 the question arose for the first time with regard to bulk supply. The whole matter was considered by Lord Cross's Committee, and that committee in their report recognised the advisability of sanctioning electric undertakings on a large scale for supply in bulk. After reviewing the history of the subject, Mr. Freeman said that last session a large number of proposals were put forward, including a Bill from the L.C.C.; the Hybrid Committee rejected the scheme and presented a report which was really the foundation and origin of the Bill now before them. The Highways Committee of the L.C.C. reported on the matter in June of last year, and subsequently a Bill was prepared. The Finance Committee of the County Council reported on December 6th on the matter, and it was this report of the Finance Committee which had greatly influenced the present Council in coming to the conclusion to lease the undertaking. Notwithstanding the report of the Committee, the late Council decided to proceed with the Bill, but the election which took place in March resulted in a distinct change in the composition of that body, and the majority which was returned was unfavourable to anything in the nature of a direct supply of electricity. A debate on the matter took place, and as the result certain alterations had been made in the Bill, which he would draw their attention to after the necessary alterations in the preamble. They would see that Clause 8 gave the Council power to supply electrical energy. Clause 9 gave the area of supply. It would be recollected that the Select Committee of last year advised that there should be a large area outside the administrative county, and on that matter there was little dispute before the Committee. The advisors to the Administrative County's Bill pointed out that it would be absurd to draw the line artificially, as many of the people they would wish to serve would be just outside the administrative county. The area of the supply had been somewhat improved this year, and now 451 sq. miles were scheduled, of which 117 were in the county and 334 in surrounding districts. This was a little more extensive than last year's area. It now included Chingford and Waltham Cross, in Essex; Croydon, Kingston, Ham, the Maldons, Merton, and Mitcham, in Surrey; and Enfield and Edmonton, in Middlesex. At the same time certain rural districts in Kent were omitted. Clause 10 was an important clause dealing with the conditions of supply, and known as the Kitson Clause. Briefly it provided that the promoters might supply electrical energy to authorised undertakers and to persons requiring a supply of power, but the supply to such persons (except railways, tramways, canals, and docks) could only be given by consent of the authorised distributor. If, however, such consent was unreasonably withheld, then the promoters could go to the B. of T., who could consider the matter and give consent. The whole object of the Clause was to ensure that a consumer should not be prevented from getting a supply, because it sometimes happened that persons who had the authority to supply were not able to give a proper supply. Clause 17 contained provisions as to the supply to certain bodies and persons, viz., railways, tramways, canal navagation, docks, or waterworks. It had always been felt that exception should be made in the case of those bodies whose works passed through a number of districts. In the case of a railway, the local authority sometimes supplied energy for the lighting of waiting-rooms, &c., but could not supply energy for working the

railway outside its area, and, therefore, as in all these power Bills, the Council reserved their right to supply these persons. Part 3 of the Bill dealt with lands and works. The Council felt that they could not hand over to anybody else compulsory powers for acquiring land. Certain land must be acquired for the generating stations, and it was proposed to take the land at Barking and Erith. In the financial part of the Bill provision was made for £100,000 for acquiring land, and that land could be handed over to the lessees who would erect generating stations thereon. In Part 4, Clause 47, dealing with the acquisition of the undertakings of local authorities in the county, had been struck out of the Bill altogether. It was originally proposed that the Council should take over the undertakings at any time after four years from the passing of the Act on the terms of taking over the debt which the local authorities then had. There was very considerable opposition to that on the ground that the local authorities pointed out that many of them were in different positions to others. Some might have a very large debt, and would not object to be taken over, while others were making profits, and would therefore be prejudiced by being taken over. As it was the idea of the present Council to transfer the undertaking (subject to their control) to a company, they felt it would not be right to enable the lessees to acquire the undertakings of the local authorities against their will, and so they had struck that out altogether, and he trusted it would have the effect of greatly reducing the opposition of local authorities. In fact, except in some small matters, he could not see that the local authorities could have much to say against the Bill. Clause 66 was the one which enabled the Council to lease the powers granted, and in a new clause they proposed certain modifications. Coming now to the new clauses, Clause 43 dealt with the question of the route for electric lines, and met the objections of the local authorities who thought that the Council would be unduly interfering with their streets. It provided for electric lines being laid down "in such line or route and in a trench of such dimensions and in such a position as may be agreed between the Council and the local authority, or, as failing agreement, shall be settled by the Board of Trade. There were a number of new clauses for the protection of certain bodies. Clause 49 was one which, instead of giving compulsory powers to acquire the undertakings of local authorities, made it solely a matter of agreement, by which the Council could acquire certain undertakings, or parts of undertakings, if the owners were willing to sell them. Clause 66A was a very important clause, as it was an endeavour to meet the instructions which had been given to the Committee by the House of Commons. It provided that if within one year from the passing of the Act, no transfer or assignment of the powers of the Act with regard to the execution of works and the supply of electrical energy had been made, the powers of the Act should cease. Every such transfer or assignment should contain conditions to the effect that the undertaking established under such transfer should be purchasable by the Council at the end of a period not exceeding 50 years from the date of transfer, on the basis of the then value of the undertaking, ascertained in the manner provided by Sec. 2 of the Electric Lighting Act, 1888, or on terms specified in the deed and approved by the Board of Trade; that the amount of the dividend should be regulated by the prices charged for electrical energy; that the maximum prices to be charged, and the relation between prices and dividend should be subject to periodical revision; and that facilities should be secured to the Council to examine at any time the accounts and works of the transferrees. The provision of one year was somewhat a short period, but they had put it in in deference to the recommendation of last year's Select Committee. This session there were three other Bills affecting the supply of power to London. That of the Administrative County had now been withdrawn. The London Electric Bill had not been read a second time, and if it was so read an instruction had been tabulated to the effect that it was to be limited for the purpose of a joint committee being formed to carry into effect any agreement with the L.C.C. The North Met. Power Co. Bill had been so limited as to exclude competition from the Council's area, and so there were no Bills competing with the Council's Bill. There were originally 86 petitioners against the Bill, but of these only 20 were represented by counsel. Seventeen were local authorities, one an electric supply company, and one a gas company. Speaking broadly, the local authorities objected to the Kitson Clause, and to the supply to railways, &c. As to the latter objection, the local authorities had no power to do this themselves, and if such companies were to have a cheap supply it must come from a central authority. Then most local authorities objected to the transfer of purchase rights, and the acquisition of their undertakings, but that had gone from the Bill. With regard to the breaking up of the streets, also a modified clause had been prepared. The Electric Supply Co. also objected to the transfer of purchase right, but that was gone. He quite recognised the difficulties which the petitioners were in owing to the alterations in the Bill. He trusted, however, that the great problem which had for so long been troubling Parliament, would now be solved once for all without putting any undue burden on the ratepayers of London.

Mr. Greig announced that the Willesden U.D.C. withdrew their opposition on preamble.

Sir R. Littler, K.C. (for the City Corporation), appealed to the Committee to adjourn and give the petitioners an opportunity of considering the Bill as now presented, but the Committee decided to proceed.

The Hon. W. Peel (chairman of the Parliamentary Committee of the London County Council), said that as originally deposited the Bill dealt with the compulsory purchase of the undertakings of the borough councils and the transfer of powers to the Council. The Bill was carefully considered by a Committee who reported on May 2nd. On June 6th a further report of the Parliamentary Committee was brought up and discussed the previous night in the Council, and it was agreed that the clauses providing for the compulsory acquisition of the electrical undertakings of the metropolitan borough councils by the Council and for the transfer to the Council of the powers of purchase possessed by local authorities throughout the area of supply be deleted; that the provision for expenditure be limited to a sum not exceeding £100,000; that the special powers sought in the Bill in regard to the breaking up of streets in London be deleted, and that the powers sought in the Bill, to enable the generating stations and other works comprised in the Council's tramway undertaking to be appropriated as part of the proposed undertaking be omitted, but that power be sought to enable the Council to supply surplus electrical energy from its Greenwich generating station for the purpose of the proposed undertaking, and to permit of the use of the Council's tramway ducts for the purposes of the undertaking.

Witness was taken through the various clauses in the Bill, and said that with regard to Clause 10 (the Kitson clause), if the distributor's prices were lower than those of the Council, they had nothing to fear. They had agreed with the North Metropolitan Co. that they should not be prejudiced by the passing of the Bill by that Committee, and the company would reserve their opposition to the House of Lords. The limitation for the use of power for lighting purposes was 20 per cent. in the Bill, and he believed in the Cumberland Bill it was 50 per cent. Clause 16 reserved to the Council power to supply their own undertakings. They had schools, &c., all over the area, and it might be convenient in certain cases to get a supply of electrical energy in this way. He expected, however, in most cases the supply would be obtained from authorised distributors. Clause 17 giving power to supply to railways, &c., was important to the Council from the point of view of cheap transit. The reason for retaining the power to spend £100,000 was because there was some technical difficulty with regard to handing over the powers of compulsory purchase of land; and, secondly, in the interests of municipal control they thought it would be a valuable thing to lease the land instead of selling it. They felt that whatever might be said about risking the ratepayers' money in laying down mains, they could not run any serious risk in the purchase of land. Clause 64 was to get linking-up powers. Clause 65 gave power to supply electric fittings, and this was a power which the Council had also obtained for the benefit of the boroughs. The reason why they put in one year in Clause 66A was that they were much impressed with the necessity of dealing with the matter as soon as possible. They had great hopes of being able to come to some arrangement with private enterprise during the course of the Bill, but they thought it better to ask for some time, and considered that one year would be sufficient for arrangements to be made. Fifty years was, of course, only the maximum period. It was true that 42 years was the period under the Electric Lighting Acts, but it had to be remembered that this was a Power Bill, and in the 26 Power Acts passed there was no precedent for purchase. Consequently they were asserting something like a new principle in setting out a purchase clause. They thought it would be wise to say 50 years, as the present was not an easy time for the raising of money.

In cross-examination by Mr. Balfour Browne, K.C. (for the Middlesex County Council), witness said a considerable portion of the scheduled area was in Middlesex. As to whether he considered it a right principle of legislation for the Council to come and get extensive powers and then within one year transfer those powers to someone who had never been before Parliament, his answer must be that it seemed a very convenient way of obtaining control. He supposed it was possible for the Council to split up the undertaking and lease different parts to 50 different persons, but they were not likely to do anything so ridiculous.

Answering Mr. Moon, K.C. (who appeared for the Electric Lighting Co.'s), Witness said they sought the powers in Clause 8 simply for the sake of transferring them, and had no intention of directly utilising those powers. If they did not transfer within a year the powers would lapse, or they might apply to Parliament for another year. Clause 49 for the purchase of undertakings by agreement was not in last year's Bill.

Mr. Moon pointed out that, in the case of Chelsea, the Chelsea Supply Co. and the London Electric Supply Co. had powers to supply, although the latter company did not exercise them. Assuming that the Bill passed without Clause 49, the only way in which the transferree could compete with the Chelsea Co. would be under the Kitson Clause; but supposing under Clause 49 the transferree purchased the undertaking of the London Co.?

Witness said that then they might be able to compete within that area.

Mr. Moon: Supposing a company like the Chelsea Co. is doing its duty, do you think it is fair that by such legislation as is proposed in Clause 49, another company, with all the advantages given it by this scheme, should come in and compete with it?—Remember, of course, that the Chelsea Co. can demand as a right to have this cheap bulk supply given to it, and having that, and having its mains already there, I should think it would have an advantage over any bulk company which would have to lay down mains.

Thursday, June 13th.

At the second sitting of the Select Committee Mr. Peel was cross-examined by Mr. Vesey Knox on behalf of the Borough of Hornsey, and the Urban District Councils of Finchley, Beckenham, and Chiswick. Witness admitted that the Bill would mean a greater interference with capital than any Bill ever permitted, subject to the reservation that the undertakers could always avoid disturbance by taking cheap power of the Council's transferree. The Select Committee of last year laid great stress upon the evi-

dence of Mr. Llewelyn Smith, of the B. of T., and Mr. Smith laid stress on the necessity of having the Kitson Clause. They felt that the B. of T. would not do anything unfair, and that as the B. of T. would have to consider all the circumstances of the case, the existing undertakers would have a fair and substantial protection. He could not say whether it was the fact that the Kitson Clause had not been given in any Power Bill where there had been more than £500,000 of capital invested in electrical undertakings.

Mr. KNOX: Here you have £20,000,000 of capital invested in existing electrical undertakings, partly by companies and partly by local authorities; don't you think under these circumstances some further protection is necessary to existing capital than has been given in the Bill?—I am inclined to think that the safeguard of the consent of the Board of Trade will be sufficient for existing capital, as the Board of Trade are entitled to take into consideration all the circumstances of the case.

Although the undertakers may think they can supply cheap power, yet you press them by threatening arbitration?—I think the proper Parliamentary phrase is that this will be a bit of ginger to assist them.

Why should you ginger them up, and make them take electricity from you if they think they can make it as well themselves?—If they can do this they won't want it. Suppose you did away with the Kitson Clause altogether. You might go to a local authority, and say, "The manufacturers in your district are receiving power at 2d. a unit, and we can supply it at ½d." In most cases, of course, the local authorities would take the power; but supposing they did not, what a difficult position the manufacturer in the area would be in. He would be prevented from getting a cheap supply, and from our point of view we are considering rather the interests of the consumers. Continuing, witness said that they had to consider the development of London in the future. Manufacturers were moving from the centre to the suburbs, and that was a thing they ought to encourage.

Have you any actual knowledge as to whether there is anybody who can carry out these powers if they are given?—We have had discussions with various sets of persons who show a willingness to come in, and ask for these powers.

Are the promoters of the Administrative Co.'s Bill amongst them?—Some of the promoters are in one set of persons.

In answer to further questions, WITNESS said the L.C.C. had lent money to local authorities in the county for electric lighting purposes. The loan was not, however, secured merely on the electricity undertaking. The local authorities outside the county had borrowed money from other sources. A supply of cheap power would increase the rateable value of London, and increase the security of the rates.

Mr. VESEY KNOX next cross-examined on behalf of the Chiswick Urban District Council, and pointed out that there was a company supplying in that district which could be purchased by the local authority in 1914. It appeared that Clause 49 of the Bill would give the transferrees power to buy the undertaking of the Chiswick company, and their term would be 42 years from the date at which they purchased it.

WITNESS said he took it that the transferrees would acquire the undertaking, subject to the conditions on which it was held.

Mr. KNOX: Supposing the transferree took over the undertaking, the right of the Chiswick U.D.C. would be postponed until 1952?

WITNESS said that was so, unless otherwise provided for. As to whether that would be a reasonable thing from the point of view of the local authority, he was thinking more of the interests of the consumers, and if a cheaper supply was given, it might not be a bad bargain for the inhabitants. Of course, it might have the effect of depriving the U.D.C. of their powers, and the only justification would be a cheap supply of electricity.

The CHAIRMAN asked if the opposition of the City Corporation to the Bill was modified, and Sir RALPH LITTLER said that the City Corporation wished to be left out of the Bill altogether.

WITNESS, in cross-examination by Sir RALPH LITTLER, said he was aware that the City was served by two companies, which were purchasable in 1914. There would be nothing to prevent the transferree buying one company and leaving the other.

Mr. BALFOUR BROWNE, K.C., examined for the Corporation of Croydon, and WITNESS said he knew the local authority there had an electrical undertaking, but he did not know that £300,000 had been spent upon it. Mr. Merz did not include Croydon in the Administrative Bill.

Questioned by Mr. BALFOUR BROWNE as to the exclusion of Croydon from the Bill, WITNESS said if they once began excluding districts they would not know where to stop.

Mr. FITZGERALD, who appeared for the Marylebone Borough Council, said witness would know that his clients purchased the undertaking of the Metropolitan Electric Supply Co. for £1,200,000, and they had to put up a generating station of their own. What they bought were the mains and the right to supply. The Metropolitan Electric Co. based part of their claim on prospective profits which they might make up to 1932, and they included the prospective value of a power supply. Under those circumstances he asked if the Council were going to allow a company to compete with them.

WITNESS: On the well understood terms.

Mr. FITZGERALD: But their position is very exceptional, and is different from the other borough councils, who only put up their works and paid nobody for the right to supply. Would you put in a clause to protect the Marylebone Borough Council?—If we do that we shall be going back to the Bill of last year, which was a permissive Bill, and was condemned by the Select Committee. The fact that Marylebone entered into a bargain, which may not be a very satisfactory one, ought not to prevent power users getting their supply cheaply.

Further cross-examined, WITNESS said it would not be dealing with the instruction if they brought a provisional draft of the terms on which they would transfer their powers and had it scheduled with the Bill. He did not see how the conditions would affect the parties before them.

Mr. BLENNERHASSETT, for the Westminster City Council, cross-examined Witness as to the possibility of the County Council themselves undertaking the supply. WITNESS said it was true that the Council might try and lease the powers for a very short time and then do the work themselves, but no one would take a lease on such terms.

Answering Mr. READER HARRIS (representing the Ealing Borough Council), WITNESS said the particular reason for including that area was a matter for the expert advisers. Even if there were no power users, the Bill might assist the local authority in their lighting business, as it was well known that the charges for house and street lighting were high in London.

Mr. WEDDERBURN, K.C., cross-examined at considerable length for the Woolwich Borough Council, and Witness denied that there would be no protection in the Bill against unfair competition.

Mr. WEDDERBURN: The L.C.C. employs the transferree to do the nasty work of underselling and cutting us out. Is he going to pay a rent? The clause says "substantial considerations."—Of course, the transferree will pay a rent for the sites which are purchased, but if we charge a large rent for the lease that will mean so much on to the price charged to the consumers, and the transferree will not be able to supply so cheaply.

And therefore he will do what he can to get back his money by squeezing his competitors as much as possible?—But we do not propose to charge an unreasonable rent. After the transferree has paid a reasonable dividend, then, perhaps, there may be some contribution to the rates.

What is to prevent your transferree in the first year of his tenure underselling us and killing our business and then raising the price to the maximum?—That would be a matter of *bona fides*, and the Board of Trade would have to take it into consideration. I do not think there is a serious danger in the first four years, of the transferree killing anybody.

Mr. WEDDERBURN pointed out that Woolwich and Shoreditch were under the Northumberland Clause, by which they had to adjust their prices each year so that no loss from the electricity undertaking should fall upon the rates, and now apparently they were to have a competitor.

WITNESS said the Borough Council could obtain a cheap supply from the transferree, although, of course, in such a case their generating stations would become worthless. On the other hand, if there was no power competition there was nothing to protect the consumer.

Mr. LLOYD, K.C., asked Witness if he was aware that Messrs. Curtis & Harvey, his clients, had the right to store 600 tons of gunpowder within 130 yards of their proposed site at Erith, and they had from 400 to 500 tons always there? Did Witness suggest that it would be a proper thing to put down a generating station there? What security of tenure would there be for the Council or his clients?

WITNESS thought something would have to be done in the way of granting compensation if Messrs. Curtis & Harvey had to remove.

Answering Mr. MOON, K.C., WITNESS said he would not say that the Bill was framed for supplying energy for electric heaters and cookers, but it was chiefly for manufacturers.

Cross-examined by Mr. MORTON, on behalf of the Borough of West Ham, WITNESS said he would consider the question of protecting the tramways against street interference by the Council. He knew that the Borough Council had an electricity undertaking, and had such a load as enabled them to supply at a low price. He would take it that the average price at which they supplied electricity for power was 1d. per unit. If the local authority supplied so cheaply, it could not be subject to competition. He knew, however, that, in some places, the price for power was low, but it was made up by the charge for lighting.

By Mr. COURTHOPE MONRO (for St. Pancras Borough Council and the Wimbledon Borough Council): The area had been considered from the point of view of economic supply. Any profits would be earned throughout the entire area, and that could only be spent within the area. He quite admitted the force of the argument that any profit should go in lowering the charges. He believed that the St. Pancras Borough Council had invested £500,000 on its undertaking.

Answering Mr. WILLIAMS (for the Stepney Borough Council). WITNESS said that at present the borough councils had to get the consent of the County Council to borrow money for electric lighting purposes, and certainly if it could be shown that the Borough Council could procure their electric energy more cheaply than they could produce, that would be an element to take into consideration as to whether the Council should grant the loan. He could not answer such a question as to whether the Council would give a special clause to Stepney similar to that which was given by the Administrative Co. in 1905. He would not be willing to leave the Borough Council the exclusive right to supply the three docks with power.

By Mr. SAUNDERS (for the Islington Borough Council): He would take it that Islington had expended nearly £500,000 on their electricity undertaking, and that, notwithstanding that they had a bad load-factor, they were selling at 1d. a unit. By Clause 10 the Board of Trade might let the transferrees into Islington to compete, but they must charge within the limits.

The Committee adjourned.

FRIDAY, JUNE 14TH.

At the resumed sitting of the Committee on Friday, the Hon. R. R. W. PEEL was re-examined by Mr. CLODE on behalf of the promoters. Witness absolutely denied that there was any understanding implied or expressed that the Administrative County Co. were to become the transferrees under the Act. It would be treated by the Council purely as a matter of business, and would be put up for tender. It was the intention of the Council to make the best bargain for London. They had every hope that there would be a good deal of competition for the powers, and as far as the Council was concerned, it was a question of a fair field and no favour to all competitors.

It has been suggested that you might split up this area and put it into the hands of a number of different companies?—The whole object of promoting this Bill is to obtain a cheap supply of electricity on a large scale for London and districts outside, and we are advised by our electrical experts that the only way to secure a cheap supply is to have it done on a large scale. We should obviously be defeating the objects for which we promoted this Bill if we were to split up this area into a number of small areas. Continuing, the Witness said that the "Kitson" Clause was described last year by Mr. Llewellyn Smith as practically the B. of T. Model Clause, and it was introduced as the foundation of the present Bill largely in consequence of the evidence on behalf of the B. of T.

With regard to the position of the City, the WITNESS said that the generating stations which supplied the City were outside London, and therefore the Corporation were not in a position to purchase them, whatever other rights they might have. All that the City had an interest in was the network of mains and the transforming stations, and presuming that they purchased those parts of the undertaking it would be not only a convenience but an absolute necessity for them to take a bulk supply. As to producing a draft lease before the Committee, he did not think that would be possible or desirable.

The witness was then examined at considerable length by the various members of the Committee.

Replying to Mr. NOLAN, Mr. PEEL said the chief difference between the present Bill and that of last Session was that the present Council were anxious that the financial and other risks of the undertaking should not fall upon the ratepayers, but that they should be taken by a company.

By MAJOR RENTON: He had no doubt that they would be able to settle a lease within 12 months of the passing of the Act. They would not seriously object to having the time extended to 18 months.

WITNESS was next questioned at some length by Sir A. SPICER as to whether the advisers of the Council had considered any scheme by which these new powers might be transferred back to them at the same period—1931—as the majority of the present London companies would become purchasable. Mr. Peel said that they had considered that matter and had given themselves freedom to adopt such a course if it were practicable under (*a*) in Sub-section 2 of Clause 66.

By Mr. A. E. DUNNE: They had not taken compulsory powers to buy out existing undertakers in the area, because it was felt that it might be dangerous to place such powers in the hands of any company to whom they might transfer the business. He would ask the Committee not to insist upon seeing the terms of any proposed lease, as, if it was made public, it would seriously hamper the Council in their negotiations.

Mr. JOHN WARD pressed the witness as to the desirability of granting a lease down to 1931. Mr. PEEL, in reply, said that would be only 24 years, and he doubted whether in that time any company would be able to make a return upon its capital, and the question was whether any body of undertakers would be found willing to take such a short lease.

Were you advised by your experts that it was advisable to have a draft lease scheduled to this Bill?—No; on the contrary, we are advised that the scheduling of a draft lease would be not only inadvisable, but practically impossible.

The CHAIRMAN said that they thought that Clause 66A hardly sufficiently carried out the mandatory instruction they had received from the House of Commons, and perhaps the promoters would consider whether they could give the Committee more information on that point with a view to carrying out the instruction strictly; they might bring forward some form of lease which should be something of a guide as to what the conditions were on which the Council were prepared to transfer their powers. They did not want to hamper the Council by asking them to give a specific lease.

Mr. FREEMAN said that the Council were in a very difficult and delicate position in the matter, because while they were most anxious to satisfy Parliament, they desired as far as they possibly could to have a free hand in dealing with their lessees.

TUESDAY, JUNE 18TH.

When the Committee resumed on Tuesday, Mr. FREEMAN, K.C., addressed the Chairman, and said that since the adjournment on Friday, the promoters had spent a very considerable amount of time in preparing a document, which might be called a lease or agreement, which, they thought, ought to meet the requirements of the Committee. Mr. Peel naturally was undesirous of putting practically a fresh document before the Committee, until it had been laid before the L.C.C.; he (learned counsel) would ask that the Committee should hear the evidence of Mr. Rider, the Council's electrical engineer, and would produce the lease the next day. Mr. J. H. Rider was then called, and in the course of his evidence put in an important series of tables. The report will appear in our next issue.

North Metropolitan Electric Power Co.'s. Bill.

A SELECT Committee of the House of Commons, presided over by Sir Joseph Leese, sat on Tuesday to consider the Bill promoted by the North Metropolitan Electric Power Co. Sir R. Littler, K.C., Mr. Balfour Browne, K.C., and Mr. Hutchinson appeared for the promoters, and the opponents were the Walthamstow U.D.C., represented by Mr. Cleece; the Harrow Electric Light and Power Co., also represented by Mr. Cleece; and the Metropolitan Water Board, represented by Mr. J. G. Fitzgerald, K.C., and Mr. Lyndon Macassey.

Sir R. LITTLER explained that the company was incorporated by an Act of Parliament in 1900, and had an area of 324 sq. miles in districts which had very rapidly increased in population. Power was given to the company to supply, but not in any district already supplied except with the consent of the authorised distributor, such consent, however, not to be unreasonably withheld. The company had obtained land by the river Lea, on which an excellent power station had been erected. In 1903, by arrangement, the company took over the undertaking of the Willesden Urban District Council, including their generating station. They had thus two excellent generating stations on the west and east of their area, and, further, they had a small generating station at Hertford. Since they had acquired the Willesden undertaking, there had not been a single power station erected in the area, as the company were able to supply all the requirements. The whole object of the present Bill was to improve their facilities for supplying the district. They had included an extended area which was, however, affected by the London County Council Bill now before Committee. They had excluded that area from the Bill on terms which were satisfactory to the County Council and the Board of Trade. With regard to the petition of the Harrow Electric Light Co., they were prepared to give a clause that no provisions in this Act should apply to them, but the company wanted a retrospective clause so that no provisions of previous Acts should apply. In consequence of the amendments made in the Bill to meet the views of the County Council, the opposition of the Walthamstow Urban District Council was reduced to one clause. By Clause 8 the promoters were seeking to extend the provisions in their 1903 Act, so as to include the North-East London Railway as being a user whom they could supply. This was a company incorporated to construct an electric railway from the City to Waltham, to run through Walthamstow. He was afraid that owing to the feeling amongst investors that these tube railways did not give a sufficient return on capital, it was not very prosperous, but if the line was constructed it would have to get electrical energy from somewhere, and Walthamstow had neither the powers nor the capacity to give the supply. At present the company were supplying the tramways constructed by the Middlesex County Council, and by the 1902 Act they had got power to supply the North-West London Railway. In their petition the Walthamstow U.D.C. said they had been induced to spend £178,324 on carrying out their obligations under their electric lighting order, and that they had been uniformly successful in working the undertaking at a profit. That was not true. They also said that they had expended £146,000 on tramways, and he believed he was right in saying that they were worked at a loss. An inquiry had been held in consequence of an application being made to the Court of Chancery to prevent the Walthamstow U.D.C. from continuing a nuisance which they created, and they had applied to the Local Government Board for a loan of £26,000 to enable them to carry out some other method. The facts which came out at that inquiry were such that the inquiry had been adjourned *sine die*, and in the meantime the company had offered to supply them cheaper than they could supply themselves. With regard to the Metropolitan Water Board petition, he contended that they ought not to have more protection than that given under the ordinary law.

(To be continued.)

Electric Lighting Provisional Orders (No. 3) Bill.—This Bill came before the Earl of Onslow's Select Committee of the House of Lords on Monday, and was ordered to be reported for third reading. The Bill confirms electric lighting orders granted in respect to Castleford, Egham, Formby, Liversedge, Coombe, Mansfield, Grimsby, Selby, Paignton, Stoke-upon-Trent and Maldens.

Devonport Corporation Bill.—On Tuesday and Wednesday last week the Bill promoted by the Devonshire Corporation for further powers with regard to various undertakings, including the electricity undertaking, came before the Police and Sanitary Committee, presided over by Mr. Corrie Grant. There was no opposition to the Bill. Mr. Vesey Knox, K.C., who represented the Corporation, in the course of his opening remarks, explained that by the Devonport Electric Lighting Order of 1896, the Corporation were empowered to supply electrical energy within the borough, and under authority granted in their Act of 1900, they accepted a transfer of the powers conferred on the Stonehouse Urban District Council by an order granted in 1898. They were now supplying under those orders, and it was expedient that further powers should be conferred upon them. The net indebtedness of the Corporation was £1,080,000, a large portion of which was due to municipal undertakings which, although not making much profit, just managed to pay their way. The electricity supply was started in 1901, and the loans outstanding amounted to £114,788, and the undertaking last year brought in a profit of just over £2,000. The prices charged for lighting were 4½d. and 4d. That did not represent a very large margin, and though the electrical undertaking was not a burden upon the rates, it could not be said that it assisted the rates very much. Replying to the Committee, Mr. Vesey Knox

said there was no renewal fund set aside for the tramways, as these were leased to a company and the company had to renew. The preamble was passed, and the Bill ordered to be reported to the House for third reading.

Dangers of Electric Generating Stations.—In the Parliamentary Papers, Mr. Cleland asks the First Commissioner of Works what steps he proposes to take to secure that the new electric generating station near the Houses of Parliament and the British Art Gallery shall be constructed and worked so as to obviate injury to the fabrics of these public buildings, the art treasures therein, and the vegetation in the Victoria Tower Gardens, which are about to be extended at great cost close up to the new station site. Mr. Harcourt replies as follows:—"I shall do my utmost to obtain the insertion of protective provisions at a later stage of a Bill now before this House. With the opinions of Prof. Church and Dr. Thorpe before me, and the knowledge lately acquired of what is happening elsewhere, I take a most serious view of the national risk which is being incurred in this matter, unless precautions are adopted, according to my recommendations, to protect the Houses of Parliament, the adjoining grounds and the British Art Gallery. I hope I shall have public support in my action."

Third Reading.—On Monday the Middlesbrough, Stockton-on-Tees and Thornaby Tramways Bill was read a third time, and passed.

King's Norton and Northfield U.D.C. Bill.—The Lord Chairman of Committees officially announces that all opposition to this Bill has now been withdrawn. The Bill contains clauses for the reconstruction and alteration of tramways.

LEGAL QUERY COLUMN.

[*Questions addressed to the Editors for insertion in this column should be written on one side of the paper. Free use of fictitious names may be made. Answers are furnished by a barrister-at-law.*]

No. 91.—Electrical Fittings.—Whether part of Freehold?

"TENANT" writes:—"Will you be good enough to inform me whether it has been definitely settled, legally or otherwise, what part of the usual wiring, consisting of wooden casings or conduit, wires and cables, branch switches on walls of rooms, ceiling roses, &c., belong to the freeholder and what part to the tenant, and which of the latter may be considered removable?"

*** There is no case in which this question has been discussed. It is apprehended that wires and cables inside casings, together with the casings, would come within the term "fixtures," while ceiling roses and switches, which can be removed by the simple process of unscrewing, would be removable. It would be interesting to hear of some decision on the point.

LEGAL.

RIMMER *v.* PREMIER GAS ENGINE CO.

THIS case came before the Court of Appeal, composed of the Master of the Rolls, the President of the Probate, Divorce and Admiralty Division and Lord Justice Kennedy, on Thursday last week, on the appeal of the Company against an award of the County Court Judge sitting at Birkenhead as an Arbitrator under the provisions of the Workmen's Compensation Act, 1897.

The short facts of the case were these. A shipbuilding yard, which consisted of three dry and one wet docks, was being constructed by private enterprise, the owners deciding to use electrical energy both for light and power. It, therefore, became necessary to erect on some part of the shipbuilding yard a station for generating electricity. For this purpose 10 gas engines had to be erected on land forming part of the shipbuilding yard. The Transmere Bay Development Co. were the contractors for the works as a whole, and the present appellants were sub-contractors for the purchase, erection and installation of the gas engines. The applicant, who was in the employment of the appellants, in the course of his employment while working at the erection of the gas engines got his hand crushed by the machinery. All the docks except one were completed at the time of the accident, the generating station being in the course of erection and completion. The County Court Judge found on the facts that the applicant at the time of the accident was employed on, in, or about an engineering work, viz., a dock within the meaning of Sec. 7 (1) of the Act, and that the appellants were undertakers of an engineering work within sub.-Sec. 2 of that section. He also found that the applicant was employed in or about a shipbuilding yard, and therefore a factory within the meaning of the Factory Act; and that the appellants were undertakers of a factory within the meaning of the Workmen's Compensation Act, 1897. He also found that at the time of the accident the applicant was employed on, in or about an electrical station, and therefore a factory within the meaning of the Factory Act, 1901, and that the appellants were undertakers of a factory within the meaning of the Workmen's Compensation Act, 1897. He accordingly made his award in favour of the applicant. Hence the present appeal of the employers.

Mr. Langdon, K.C., and Mr. Lord appeared for the appellants, and Mr. Tobin, K.C., and Mr. Cuthbert Smith for the respondent on the appeal of the workman.

The MASTER OF THE ROLLS and the PRESIDENT held that there was no evidence on which the County Court Judge could find that the applicant was engaged "on, in or about the construction of a dock," and that the appeal should be allowed.

Lord Justice KENNEDY differed. He thought it was straining the language of the Act against the workman to hold that because the place where the accident happened was not within the wall of the dock, though it was within the same area as the dock, it could not be treated as a part of the construction of that which was intended to be an essential part of the dock. He could not see that the County Court Judge had misdirected himself on the law.

By a majority of the Court, therefore, the appeal was allowed.

VICKERS, SONS & MAXIM, LTD., *v.* THE COVENTRY ORDNANCE WORKS, LTD.

IN the Chancery Division of the High Court on Tuesday, before Mr. Justice Warrington, COUNSEL said this was a patent action, which came before the Court on May 10th, upon a motion. It was an action of great importance, as large contracts depended upon the result. Evidence had been filed in support of the motion, which was considered not enough to justify the granting of an interlocutory injunction, and the defendants were prepared to ask his Lordship to dismiss the motion, but could not get the plaintiffs to set down the case for trial.

His LORDSHIP said he would give the defendants leave to set the matter down for trial at once.

On Wednesday, however, COUNSEL for the plaintiffs applied to rescind the order; a summons for particulars was pending, and it was not desirable that the action should come into the list before these particulars were given.

His LORDSHIP directed that the case should not come into the paper for trial except on the application of one or other of the parties; then either party could apply to have the stay removed. He would hear the summons for particulars in Chambers on Monday next.

ACCIDENT AT AN ELECTRIC GENERATING STATION.

ON Monday, in the Shoreditch County Court, before his Honour Judge Smyly, K.C., and a jury, Thomas Pitt Curd, suing through his father as best friend, he being an infant, of 53, Wigston Road, Plaistow, E., a joiner's mate, was plaintiff in an action brought under the Employers' Liability Act to recover £337 7s. damages for personal injuries received, from Messrs. Ferranti, Ltd., of Hollinwood, near Manchester, engineers.

It appeared that the accident occurred during the erection of the fittings in the high-tension chamber in the electric substation of the L.C.C. in Rivington Street, Great Eastern Street, Shoreditch. The plaintiff, a lad of twenty, was earning at the time an average of a little over £2 a week. In one corner of the chamber which was being fitted, which was about 90 ft. by 60 ft., a fire had been made at which was boiling a quantity of composition for jointing purposes. Plaintiff's duty was to fill a can with this composition and carry it across the chamber over an accumulation of rubbish. Owing to the poor lighting, plaintiff fell, upsetting the contents of the can over his hand. The accident happened in January, and one of the fingers was still much displaced through the burning up of the joint.

The plaintiff was called and said that he had never seen the defendant firm use anything but beer cans for the carrying of the composition, although in his opinion utensils of a much safer character should be used. For the defence it was submitted that there was no negligence on the part of the defendants in respect of works, machinery and plant. The plaintiff knew the stuff was lying about the floor, and should have used care to avoid it. Also there were four other firms in different trades who had contracted for various portions of the work, and were carrying out operations at the same time. If the plaintiff had asked for more light he could have had it, as well as gloves for his hands, or a utensil other than the beer-can if he wanted it.

Eventually the jury found for the plaintiff for £125 and costs.

Rail Welding.—MESSRS. THERMIT, LTD., have received the order for welding joints on a small extension of the tramways system to be carried out by the Portsmouth Corporation.

Royton Electric Lighting.—The B. of T. has revoked the 1901 Electric Lighting Order.

BUSINESS NOTES.

Price Reduction.—The Union Electric Co., Ltd., this week announce increased discounts on their D.C. motors and dynamos.

Gas Power Plant.—Messrs. Masons Gas Power Co., Ltd., of Alma Works, Levenshulme, Manchester, have recently received the following orders:—

For the new works of the Schoen Steel Wheel Co., Ltd., Leeds, "Duff" producers, "Weardale" furnaces and steel chimneys.
1,500 B.H.P. power gas plant, to the order of Mather & Platt, Ltd., for South Wales; to use cheap bituminous slack.
For the works of the Cape Copper Co., South Wales, "Duff" producers, coal bunkers, &c.
Also "Duff" producers with accessories for Brown, Bayleys' Steel Works, Ltd., Sheffield; Latch & Batchelor, Ltd., Birmingham; the Consett Iron Co., Ltd., Durham; a shipment of "Duff" producers to Japan, and suction gas plant to the Mansourah Electric Supply Co., Egypt.

Electrical Machinery in Turkey.—The *Manchester Daily Guardian* says that an announcement has been received at the Manchester Chamber of Commerce from the British Chamber of Commerce of Turkey (Constantinople), referring to the probable extension in the near future of the electrical industry in the Ottoman Empire. "English contractors should, it is pointed out, take steps to place themselves in a position to tender when necessary. The number of electrical installations in Turkey is steadily increasing, and the Government contemplate electrically lighting the capital and other cities and also undertaking the supply of power for the tramways. It is suggested that contractors and electrical firms in Great Britain should appoint agents in Constantinople, and be prepared to send experts to Turkey whenever necessary. This is the practice of German and Belgian electricians, and the former have hitherto obtained most of the contracts for the electrical undertakings. If British contractors will take the same steps they should be able to secure a fair amount of business. It is reported that there is at present some disposition on the part of the Ottoman Government to favour British enterprises. The secretary for the North of England of the British Chamber (Mr. George Thomas), who makes the communication, will be pleased to obtain any further information which may be desired by firms interested."

Telephone Cabinets.—The Westphalien Steroxyle Co., of 7, King Street, Cheapside, E.C., have sent us a booklet relating to their "Steroxyle" telephone cabinets, which they supply complete and for which they claim many advantages over the ordinary telephone box, they being much cheaper and more artistic, inasmuch as they can be made to suit the existing surroundings, in any wood, and in any design. They are constructed in such a way as to render them absolutely sound-proof. It is believed that there is a good opening for these boxes, particularly in private houses where telephone cabinets have not so far been used on account of the difficulty and expense of obtaining a suitable article. The Steroxyle cabinets may be had in any wood, stained and varnished, or polished, for walls or corners, with straight or convex fronts and gun-metal or brass fittings. Although this is not absolutely necessary, cabinets may be fitted with specially designed automatic ventilators at a small additional cost. As only wood (without joint) is used on the inside, and no padding or upholstering of any kind, the construction is very sanitary. The cabinets are supplied ready to be screwed together, and are quite portable.

Bankruptcy Proceedings.—Mr. H. Coates, of Perth, was recently examined in bankruptcy, before the Sheriff, when it was stated that the deficiency amounted to £66,464. In answer to questions by the trustee, Mr. G. A. Miller, solicitor, Perth, Mr. Coates said he had advanced large sums of money to various trading companies. His money losses for the last five years amounted to £70,815. The examination, which was adjourned, pointed to the heavy losses being sustained through unfortunate speculations.

G. M. Sellick, manufacturer of electrical assessories, Romford Road, Forest Gate. June 29th is the last day for receipt of proofs of intended dividend, by Mr. Egerton S. Grey, official receiver, Bankruptcy Buildings, Carey Street, W.C.

Liquidations.—McPhail and Simpsons' Dry Steam Patents Co., Ltd., Calder Works, Wakefield.—A first dividend of 3s. 4d. in the £ is payable July 1st, by Mr. J. W. Close, North British and Mercantile Buildings, East Parade, Leeds.

The Improved Electric Supplies, Ltd.—The statutory first meeting of the creditors and shareholders in this matter was held on Thursday last week at the London Bankruptcy Court, before Mr. W. J. Warley, Official Receiver. After discussion, a resolution was passed for the Official Receiver to remain in charge of the liquidation, with the assistance of the following committee of inspection, viz.:—Mr. Marshall (Union Electric Co.), Mr. Unwin (The Electrical Co.), and Mr. Krupka (Krupka & Jacoby). At the meeting of shareholders held later in the day, the resolution passed by the creditors was confirmed.

Book Notices.—*La Construction des Machines Electriques.* By J. Dalémont. Paris: Ch. Béranger. 1907. Price 12.50 fr.—This is an excellently illustrated work of 134 pages dealing with the practical construction, in the works, of electrical machinery; confining itself, however, to the purely electrical portion, and not dealing with mechanical parts such as shafts, bearings, bed-plates, &c. Sheet-iron work is first taken, the various processes of cutting and punching being described, together with the most modern machinery for the purpose. Illustrations are also given of machines for papering and varnishing the plates. A large portion of the book is devoted to windings, many different designs of formers and machines for producing and insulating formed coils being described. Windings for turbo-generators also receive attention. In this chapter are a number of photographs taken with a stereoscopic camera, no doubt with the idea of bringing out more distinctly the shapes and arrangements of the formers, &c. The construction of commutators is next treated, and there is then a chapter on the assembly and erection of the parts, and balancing of the rotors. In an appendix the author deals with the organisation of the factory and testing of machines.

Les Alternateurs à Collecteur Monophasés et Polyphasés. By Ch. Jaquin. Paris: Gauthier-Villars. 1907. This little work treats of machines, the designs of which are at present out of the way of every-day practice, and which, on that account, are deserving of study. Single-phase commutator motors of the simple series, compensated series, repulsion, and compensated repulsion types, all being treated very fully. A short chapter is given to self-exciting commutator alternators. Among train lighting dynamos a description is given of the Rosenberg dynamo, which gives a current, the direction of which is constant irrespective of the direction of rotation, and which gives a constant voltage over a wide range of speed. The Leitner-Lucas machine is also described.

Flying Machines. By A. W. Marshall, M.I.Mech.E., and H. Greenly. London: Percival Marshall & Co. Price 1s. net.—This is a popular account of flying machines of all kinds, past, present and future, and includes dirigible balloons within its scope. It may be that man will acquire means of aviation in the future; the past and present devices, however, are rather machines that were meant to fly than flying machines, and have been mainly useful for the self-advertisement of certain sensational daily papers. The word "Æronautics" in the preface is attributed to the *Encyclopædia Britannica*—we hope in error; it is not so printed in the supplementary volumes, at all events, nor in the body of the present work. There is little of electrical interest in this subject, and unless some remarkable improvement in primary or secondary batteries is made, there is little likelihood of electricity taking any prominent part in aeronautics; the internal combustion engine is here pre-eminent. A large section of the book is devoted to the history and evolution of dirigible balloons, which have attained a large measure of success. Next comes an account of the experiments which have been made with a view to the construction of flying machines "heavier than air." The descriptions, which are freely illustrated, are most interesting, and indicate the large number of inventors who are at work on the problem. Chapter IV deals with the "art of flying" in general, and Chapter V discusses the future of the art, in hopeful vein. The book is thoroughly interesting and well written.

Was sind und wie entstehen Erfindungen? By Josef Löwy. Vienna: A. Hartleben. Price 1 M.—This pamphlet contains a popularly written application of Darwin's theory of evolution to the mental processes involved in the production of inventions. Invention, the writer maintains, is not a matter of chance, but follows either consciously or unconsciously, a definite method. This method consists in devising extensions to man's natural powers so that the results attainable may increase more rapidly than, but in the same direction as, would be the case under the unaided action of the ordinary evolutionary laws of the "survival of the fittest," and "natural selection." Up to a certain stage of development these latter laws alone may be supposed to have acted, but when the mind, in the general advance in power, had attained a certain capacity, it commenced to work on its own account directly towards the desired end. This would be the beginning of the age of mechanical invention, and one of its direct results would be the decay rather than the further development of man's natural powers with the exception of the powers of the mind. Another point which the author considers, is the position of the inventor as distinguished from the ordinary man. In most cases the man who gives his name to an invention, is, quite obviously, only the man who carries the load the last few steps in a long journey, the greater part of which has been accomplished by the successive labours of numerous other men. An inventive genius may cover an unusually large stretch of the journey, but unless he is fortunate enough to arrive at a practical solution, and so prove the usefulness of his invention to his fellow men by occular demonstration, he is peculiarly liable to miss his reward. The very fact that the suggested invention is a real and large advance on the existing conditions will prevent the average man from grasping its significance. From this fact the author predicts an ever-increasing rate of advance in culture and civilisation, through inventions, as the scientific education of the general public improves.

Schalttafelbau. By A. Boje. Vol. 10 of "Bibliothek der gesamten Technik. Hanover: Dr. Max Jänecke. Price 2 M. 80 pf.—The subject of switchboard design is still in a comparatively unstandardised state, and any attempt to deal with it comprehensively at present would result in a large and probably unreadable volume. No such attempt has been made in this book as the writer confines himself to practically a single case—viz., that of a 440-volt three-wire station with battery—but deals with this thoroughly, and in detail on the lines of recent Continental practice. In certain points this differs from the corresponding English practice, though not to any great extent, and the first-hand practical knowledge of the whole subject exhibited by the writer, gives the book an independent and general interest. The relative values of switches, instruments and other individual parts of the board are critically discussed, and besides the main switchboard, auxiliary boards for various purposes such as the lighting of the station, charging customers' accumulators for motor-cars, &c., instrument and meter testing, photometrical tests, &c., are fully

described. In the second part details of consumers' distributing boards for house lighting, arc lighting, motor starting, &c., are given. The book is well illustrated by line drawings, as well as half-tone reproductions of finished boards.

"Pocket Book of Electric Lighting and Heating." By S. F. Walker. London: Crosby Lockwood & Son. 1907. 7s. 6d. net.

"Pocket Book of Electrical Rules and Tables." By J. Munro and A. Jamieson. 18th Edition. London: C. Griffin & Co., Ltd. 1907. 8s. 6d.

"Journal of the Institution of Electrical Engineers." Vol. 38, No. 183. London: E. & F. N. Spon, Ltd. June, 1907. 5s.

"British Standard Specification for Portland Cement."—It is announced that this specification, which has worked exceedingly well since its first issue, has been revised, and will be ready for issue to-day. Copies can be obtained from Messrs. Crosby Lockwood & Son, or the Committee, price 2s. 6d.

"Concrete Steel Buildings," by W. N. Twelvetrees. London: Whittaker & Co. 1906. 10s. net.

Trade Announcements.—MESSRS. R. J. NICHOLSON and Co. inform us that their office for the Midlands is at 3, New Street, Birmingham, where Mr. John E. Corby will give all information respecting the "Ideal" electric lighting sets, pump combinations, and marine motors.

MESSRS. LUDWIG LOEWE & Co., LTD., of Farringdon Road, E.C., state that, owing to the completion of an extensive new factory, they are now able to give prompt deliveries of their D.W.M. ball bearings. The combined factories enable the output to be trebled.

MESSRS. W. F. DENNIS & Co., of 49, Queen Victoria Street, E.C., have been appointed the sole agents for the United Kingdom and Colonies for "Kryptol" for producing heat electrically.

MESSRS. MAWDSLEY'S, LTD., Zone Works, Dursley, Glos., announce that they have appointed MESSRS. POOLEY & AUSTIN, 25, Victoria Street, S.W., sole London agents for the sale of their patent "Zone" dynamos and motors. Other agencies are now being arranged, and will be announced in due course.

MESSRS. ADAMSON RAMSBOTTOM & Co., LTD., of Birkenhead, have appointed MESSRS. ROBINSON & JONES, 21, Collingwood Street, Newcastle-on-Tyne, their sole agents and representatives for the Northern Counties, including Northumberland, Durham, Westmorland, Cumberland, and Cleveland District of Yorkshire, for electric and hand cranes, and all kinds of electrically-driven lifting machinery and haulage gears.

Mr. F. BENNETT PELL informs us that he has severed his connection with Messrs. Turner & Manville, Ltd., for whom he acted as manager of their electrical department (formerly known as the British Johns-Manville Co., Ltd.), and has joined Messrs. Tramway Supplies, Ltd., of Leeds and London, as their London manager, with offices at 22, Walbrook, E.C. Telephone, 3179 London Wall.

TRAMWAY SUPPLIES, LTD., has been formed to take over the tramway equipment department of Messrs. S. Dixon & Son, Ltd., of Leeds and London, for the sale of "Turner's" automatic point controller, trolley line materials, &c.

MESSRS. THE NORTHERN ELECTRICAL Co. write to contradict the announcement in our last issue that Mr. J. P. Child has taken over the whole of their connection in Doncaster. Mr. Child has left their employ, and has no connection whatever with them; they have closed their Doncaster branch, but any work which they undertake in Doncaster or elsewhere will be carried out as before, excepting that it will be superintended from their Grimsby office.

Catalogues and Lists.—THE TITAN PACKING CO., 2 and 3, Tower Royal, Cannon Street, E.C.—32-page pamphlet giving illustrations and particulars of their rubber and asbestos goods, including packings, jointings, gasketings, &c.

THE SUN ELECTRICAL Co., LTD., Charing Cross Road, W.C.—Catalogue of electric motor-fans of ceiling, table, desk, and bracket types, also revolving and oscillating fans, punkah, ventilating ring, centrifugal and other fans. Loose lists of sliding pendant fittings and cheap stock lines of fittings have also been received.

MESSRS. J. BURNS, LTD., 189, Central Street, London, E.C.—Small pamphlet relating to Carl Egner's patent method of fastening insulators.

MESSRS. DOULTON & Co., LTD., Lambeth, S.E. — Illustrated circular (No. 93) showing porcelain, G.P.O. and high-tension insulators, vitrified stoneware insulators, third-rail insulators, floor and wall insulators, rack insulators, and bridge insulators for solid cable systems. As the electrical trade is aware, Messrs. Doulton are large makers of insulators, which they supply to the G.P.O. telegraph department, railway companies, electric supply and traction undertakings, &c. A second publication contains good illustrations and particulars of their conduits, single ducts, and troughing, bridge insulators, &c., for underground cables.

MESSRS CROSIER, STEPHENS & Co., Newcastle-on-Tyne.—Leaflet relating to "Cromil-Acheson" graphite paint for protecting structural iron and steel work.

MESSRS. DAVIDSON & Co., LTD., Sirocco Engineering Works, Belfast.—New bulletin (No. 2,003A) relating to their Sirocco electric propeller fans for direct and alternating currents.

ROCKWELL ENGINEERING Co., 26, Cortlandt Street, New York.—Leaflets giving brief particulars and sizes of their rod and bolt heating furnaces (oil or gas fuel).

MESSRS. KOLBEN & Co., 20, Budge Row, Cannon Street, E.C.—Pamphlets as follows:—No. 45, showing and describing briefly the Francis turbines; No. 47, relating to Pelton wheels; and No. 60, dealing with double-drum hauling gear for mining.

THE KEIGHLEY ELECTRICAL ENGINEERING Co., LTD., Vulcan Works, Keighley.—16-page brochure giving an illustrated account of their patent electric elevators, system of control, safety gear, &c.

MESSRS. E. FIGUERAS & CIE., 4, Rue Pajol, Paris.—Leaflet describing a neat little ventilating fan, which can be plugged into an ordinary lamp-holder, and takes no more power, it is stated, than one-fifth that of a 16-C.P. lamp.

"LA INVICTA" CONSTRUCTIONS ELECTRO-MECANIQUES, 4, Rue Pajol, Paris.—Leaflet showing new ventilating fans of various types, of aluminium, driven by electric motors.

ADAMS MANUFACTURING Co., LTD., 106, New Bond Street, W.—Leaflet No. 33, illustrating the "Igranic" automatic self-starting D.P. switch for A.C. motors, single, two or three-phase, starting without external resistances; also a float switch and pressure regulator, for use in conjunction with this switch for controlling air compressors and hydraulic accumulators.

MESSRS. CLARKE, CHAPMAN & Co., LTD., Victoria Works, Gateshead.—Catalogues of water-tube boilers, and boiler feed pumps (Woodeson's patents). The Woodeson boiler consists of a number of horizontal steam and water drums joined by straight and nearly vertical tubes, for which a high degree of efficiency, accessibility and simplicity is claimed. Internal superheaters can be fitted, and a set of tubes at the back to act as an economiser. The catalogues are accompanied by a book containing the names of users of the pumps, and a long list of boilers supplied or on order.

THE SANDYCROFT FOUNDRY Co., LTD., Chester.—Catalogue—or rather, book—describing the mining machinery made by the firm, which includes breakers, stamp mills, cyanide plant, crushing machinery, and all sorts of engines, pumps, air compressors, boilers, gearing, &c., for mining purposes. The book is fully illustrated, and forms a treatise on mining machinery in itself.

MESSRS. PEIRSON & Co., 17 and 18, St. Dunstan's Hill, E.C.—Handbook of constructional steel and ironwork, with tables of strength of steel joists and girders, flooring plates, &c., weights of steel angles, bars and plates, and other data.

MESSRS. HERBERT MORRIS & BASTERT, LTD., Empress Works, Loughborough.—Book 57, describing the firm's travelling cranes, of which there are stated to be 600 to 800 in stock, and 2,000 to 3,000 in course of construction. The types made include 3-motor electric cranes, partly electrical cranes, and hand cranes, as well as pulley blocks, run-ways, &c.

MESSRS. DAVIES BROTHERS & Co., LTD., Crown Works, Wolverhampton.—Illustrated catalogue of iron roofs and buildings, constructional ironwork, tanks, &c.

THE UNION ELECTRIC Co., LTD., Park Street, Southwark, S.E.—Catalogue No. 90. Condensed list of dynamos and motors, arc lamps, switchgear, meters, &c., abstracted from the company's fuller price lists (of which a list is given) and showing the goods most in demand.

LIGHTING and POWER NOTES.

Acton.—The Metropolitan Electric Supply Co. has intimated to the U.D.C. its intention of spending some £20,000 in mains extensions in the district, also of revising the charges for energy, with a view to reducing them.

Aberdeen.—The county authorities of Aberdeen have decided to continue their opposition to the Aberdeen Corporation Bill (which proposes to acquire the Deeside and district electricity undertaking at Cults, and to extend the area of supply) and to present a petition to the House of Commons.

Ashton-under-Lyne.—The Audenshaw U.D.C. has asked the T.C. to take a transfer of the E.L. order from Manchester T.C., as the latter body finds that the cost of supply, owing to distance, would be too great. Ashton T.C. is considering the matter, and meanwhile Audenshaw U.D.C. is ascertaining the probable number of consumers for light and power.

Bexhill-on-Sea.—A L.G.B. inquiry was held on June 11th, into the application of the T.C. for a loan of £5,700 for additional plant at the electricity works. There was no opposition.

Brentford.—The Guardians have finally resolved not to enter into an agreement with the Heston and Isleworth U.D.C. for a supply of electricity in bulk for their new workhouse buildings. The Council would have to spend £4,000 on new mains, and had asked the Guardians to guarantee a minimum consumption of 50,000 units at 3d. per unit for five years. Acting on the advice of the L.G.B., the Guardians have rejected the arrangement.

Cardiff.—The accounts of the electrical undertaking show an income during the past year of £35,576, and an expenditure, exclusive of financial charges, of £25,930. After meeting loan charges, a deficiency of £4,638 remains, which is partly covered by the previous year's balance. Mr. Ellis, in his report, states that the deficit is due to reduction in charges during the past year, but that a large extension of plant is just commencing to earn revenue, and he anticipates a large profit during the coming year.

Farsley.—The U.D.C. has decided to ask the B. of T. to extend the E.L. order for three months to enable arrangements to be made for transferring the order to the Yorkshire Electric Power Co.

Gosport.—The E.L. Co. has informed the U.D.C. that energy for lighting will be available at the end of June, and that the charge will be 4½d. per unit.

Electricity on the ss. "Mauritania."—The electrical equipment of this new Cunarder comprises four 440 KW. turbo-generators for supplying some 5,000 16 C.P. lamps, search light, &c., and driving some 60 ventilating fans, stokehold fans, refrigerating plant, hoists, bulkhead doors, and other auxiliary plant.

Gravesend.—By 10 votes to 8 the T.C. has decided not to take any further action under the E.L. extension to Northfleet Order, 1905.

Hipperholme.—The U.D.C. has sealed an agreement with the Electrical Distribution Co. for a supply of electricity to the district.

Keady (County Armagh).—The Urban Council is contemplating an electric lighting scheme for the town, and has received plans of the proposed installation from Mr. Meenan, electrical engineer, Dublin.

Kirkintillock.—The B. of T. has intimated to the T.C. that the Electric Lighting Order of 1903 has been withdrawn.

London.—HAMPSTEAD.—The profit on the past year's working of the electrical undertaking amounted to £3,683. Including £2,299 brought forward, the balance amounted to £5,982. This has been allocated as to £2,113 to the rates and £1,663 to alterations to plant, &c., leaving a balance carried forward amounting to £2,206.

BERMONDSEY.—A communication is to be addressed to the B. of T., protesting against the needless expenditure which would be involved by the establishment of testing stations by the L.C.C. It is intended that consumers who use light in the daytime shall in future be supplied at power rate—namely, 1½d. per unit between midnight and sunset, and at lighting rate, viz., 3¾d. from sunset to midnight.

SOUTHWARK.—The Comptroller of the L.C.C. has informed the B.C. that the Finance Committee of the former body has considered letters and a report with reference to the B.C.'s electricity fund, and has expressed the opinion that it would be glad to see any proposals carried out for strengthening the reserve fund. The Committee suggests the advisability of making an arrangement whereby the existing electric lighting loans may be repaid in the periods recently adopted by the L.C.C., instead of in 42 years, the term originally granted.

Luton.—The L.G.B. has sanctioned a loan of £14,460 for additional plant for the electricity works, extension of buildings, mains, house services and meters. The T.C. applied for £17,000, and the L.G.B. has deferred an item of £2,500 for machinery and plant for the proposed tramways until it is ascertained whether it is actually required, and a sum of £40 for an outstanding debt is disallowed.

Manchester.—The output of electricity during the past year from Manchester's three generating stations amounted to 63,056,914 units as against 55,025,966 units in the previous year—an increase of 14·59 per cent. The quantity measured and accounted for was 55 361,612 units, showing a difference of 11,695,302 units, or 18 55 per cent., this being the quantity used in distribution, or otherwise not accounted for. The corresponding percentage in the previous year was 19·50. The total mileage of main conductors laid at March 31st, 1907, equals 322 miles 83 yards, being 20 miles 1,439 yards more than at March 31st, 1906.

A report presented to the Electricity Committee at its last meeting shows that, on March 31st last, there was a net surplus of £26,267 on the year's working, against £16,219 at the corresponding date in 1906. A sum of £2,352 has been appropriated for extension of works, for which borrowing powers cannot be obtained, and the balance, £23,915, has been carried to the reserve fund. The renewals suspense account amounted to £74,590 at the beginning of the financial year, and has since been increased by a further contribution of £40,000; but certain abnormal expenditure, totalling £13,978, on discarded plant and mains, having been debited during the year, the account only shows a net increase of £26,022, leaving a total balance at March 31st, 1907, of £100,612. The reserve fund at March 31st, 1906, stood at £34,836. During the year there has been charged to this fund £6,402 for expenditure in respect of vibration at the Dickinson Street station and in respect of two street explosions. From this account there has also been transferred the cost (£47,122) of the warehouse property in Dickinson Street and Bloom Street, the transfer being due to the fact that the purchases were an application of the reserve fund, and not an investment permitted by the Manchester provisional order. On the other hand, there has been credited a sum of £1,096 for interest and £23,915, being the net surplus on the year's working. The balance carried forward is, therefore, £6,323. During the year the L.G.B. granted additional borrowing powers to the extent of £165,136, and an application for further powers is now under consideration. The various amounts sanctioned came to £2,545,941. The capital outlay shows a total at March 31st, 1907, of £2,338,373.

The Electricity Committee contemplates making reductions in its charges for electricity for lighting purposes. It recommends the following for the approval of the City Council: (*a*) To consumers on the flat rate a reduction from 4½d. to 3¾d. per unit. (*b*) To long hour consumers a reduction from £7 per KW. of maximum demand, and 1¾d. per unit, to £7 per KW. of maximum demand and 1½d. per unit. Both alterations will take effect from December 25th next.

Satisfactory progress has been made with the work required to give effect to the engineer's scheme of closing down the Dickinson Street generating station and transferring the load to Stuart Street during the six summer months in each year. The scheme is expected to come into operation at June 30th of this year. Messrs. Willans and Robinson, who have the contract for a 6,000 KW. Willans-Siemens turbo-generator set for Stuart Street station, expect to have this set running by December next. To cope with the continued increased demand for supplies of electricity, more particularly for power purposes, there have been installed at several of the distributing stations during the year an additional 3 500 KW. of transforming machinery, including the plant required for the new tramway services to Chorlton-cum-Hardy and Altrincham.

The important scheme of laying new high tension feeders from Stuart Street to Dickinson Street, and the provision of spare ducts, is nearing completion. Extra high pressure mains have been laid during the year in connection with three-phase supplies to a number of large works, to supply the following firms:—Shaw, Jardine & Co., cotton spinners, Butler Street; Hans Renold, engineer, Burnage; Richard Johnson & Nephew, engineers, Bradford; Kendall & Gent, engineers, Gorton; Mather & Platt, engineers, Newton Heath; Armstrong, Whitworth & Co., engineers, Openshaw; and Johnson, Clapham & Morris, engineers, Moston.

The T.C. on June 12th decided to apply for a loan of £112,850 for electrical extensions, as detailed on p. 924.

Neath.—The R.D.C. has engaged Mr. Ellis as consulting engineer in connection with the E.L. scheme, at a fee of 50 guineas.

Newport.—The accounts for the year ending March 31st, 1907, show receipts amounting to £27,245. The working expenditure amounted to £14,119, and interest and sinking fund to £15,411, leaving a deficit of £2,286; while the adverse balance of last year. £372, and the outstanding balance on the exhibition account, £206, have still to be dealt with. It is pointed out that the increased cost of coal, £4,892, compared with an estimate of £3,700, explains more than half the loss, while the lower charges introduced about a year ago have further reduced the profits.

Portrush.—At an adjourned meeting of the Urban Council on the 13th inst., Mr. J. H. Caskey presiding, specifications submitted by Mr. Woodside, electrical engineer, Belfast, for the electrical lighting of the town were discussed. The further consideration of the scheme was postponed till next week. The plan has been on hand for a long period, owing, it is alleged, to some feeling in the matter amongst the members of the Council.

Romford.—The B. of T. has revoked the 1900 E.L. order.

South Wales.—We understand that a scheme has now been arranged for carrying on the South Wales Electrical Power Distribution Co.'s undertaking, and that additional capital will be provided by local firms interested in the company's operations. The affairs of the company have undergone a thorough revision with a view to placing the concern in a sound financial position.

Taunton.—The statement of accounts in connection with the electricity undertaking for the year ended March 31st last shows a net profit, after meeting all charges, of £336, making, with the sum of £42 brought forward from the previous year, a total surplus of £378. The sum of £350 was voted to reserve, and the balance carried forward.

Tottenham.—For some time past the Council has been urging the North Metropolitan Electric Power Supply Co. to proceed with the installing of the electric light in the district. The company and the Council are apparently at loggerheads over other matters, and the company declines to proceed until these are settled.

Willesden.—The U.D.C. has decided to extend its street lighting by the addition of 66 Oliver arc lamps.

TRAMWAY and RAILWAY NOTES.

Belfast.—At the weekly meeting of the Tramways and Electrical Committee, Mr. Nance, the manager, submitted a special report on the proposed extensions of the tramways system for which the citizens are agitating. These were four in number—from Shaftesbury Square, along the Donegall Road to Falls Road; Shaftesbury Square to Ormeau Road, *vid* Botanic Avenue and University Avenue; from Mountpottinger to the Castlereagh Road; and from Peter's Hill to the Cliftonville Circus, *vid* Old Lodge Road, Old Park Road and Agnes Street. The manager estimated the cost of these extensions at £108,000. It was stated that the Ligoneil extension, not included in the above, would receive the fullest consideration, and it would be one of the first dealt with. The manager was of opinion that no extensions should be taken in hand for a couple of years.

Blackburn.—The eighth annual report of the tramway undertaking shows a total revenue of £54,951, and working expenses amounting to £33,531; financial and other charges absorb £20,909, and the surplus on the year amounts to £511. Some 10 million passengers were carried during the year, the revenue amounting to 12·64d. per car-mile.

Cardiff.—The tramway income during the past year was £119,115, as compared with £113,903 in the previous year. After meeting working and financial charges, a surplus of £4,405 remains, as compared with £3,411 in 1905-6. It is recommended that £6,456 should be appropriated from the revenue balance, which amounts to £10,265, and carried to a suspense account pending the issuing of a fresh loan.

Continental Notes.—AUSTRIA.—The American "International Railway Company" has applied for a concession for the construction of an electric railway from Vienna to Ofen-Pest.

SPAIN.—The Sociedad Tramway de Valencià à Moncada has been formed at Valencià for the construction of an electric tramway from Valencià to Moncada.

The Direccion de Obras Publicas of Madrid propose to grant a concession for the construction of an electric tramway in San Sebastian.

Dundee.—The T.C. is considering a proposal to establish a superannuation fund for the tramway employés.

Gloucester.—A special committee of the City Council has been appointed to consider whether the tramways shall be continued as a municipal undertaking. The past year's deficiency, after meeting financial charges, amounted to £4,500.

London.—L.C.C.—At Tuesday's meeting the Council resolved that in cases where tramways are constructed on new or existing routes, or where it is decided to renew the paving of existing tramways, the portions of the tracks opposite elementary and secondary schools, polytechnics, and other educational institutions, wholly or partly maintained by the Council, and abutting on the roads in which such tramways are laid, should be paved with wood or other silent material, provided that the remainder of the carriageway opposite any such school or institution is similarly paved.

Mr. E. Schenk, as chairman of the Crystal Palace Company, together with a deputation from the Camberwell B.C., has interviewed the Highways Committee of the L.C.C. regarding the necessity of extending the South London tramway system to the Crystal Palace.

Progress is being made with the extension of the L.C.C. tramways from Tooting Broadway to the High Street Railway Bridge, where they will connect with the London United Tramways, which will shortly run *via* Wimbledon, Malden, and Surbiton to Hampton Court. Another route to be shortly commenced is that from Tooting Corner to the Hop Exchange. This will be extended to Tooting Junction, and will meet the South Metropolitan Tramway Company's cars now running between Tooting Junction and Croydon.

CHARING CROSS, EUSTON AND HAMPSTEAD TUBE.—Trial runs have recently been made on this line, which is to be opened tomorrow by Mr. Lloyd George.

It is proposed to run a 12-minute service between Charing Cross and Golders Green, a 4-minute service to Hampstead and Highgate, and a 2-minute service to Camden Town, where the line branches to left and right.

The journey between Charing Cross and Golders Green occupies some 20 minutes, and the latter station is in the open.

CENTRAL LONDON RAILWAY.—It is understood that, as a result of the mutual agreement as to increased fares, this company will adhere to a 2d. fare for distances not exceeding 3½ miles, and will charge 3d. for greater distances. No alteration will, however, be made in workmen's fares.

London United Tramways.—This company is applying to the Light Railway Commissioners for an order extending the period for taking land and constructing light railways (electric tramways) from Twickenham Green to Hanworth, and from Hounslow Broadway to Hanworth. The order expires in November next, and the Company is asking for 10 years' extension. The Twickenham U.D.C. and the Heston and Isleworth U.D.C. are opposing the application.

The Heston and Isleworth U.D.C. has notified the company that, if it does not fix a definite time for the commencement of the extension of the line from Hounslow to Staines, the Council will oppose every order and Act that it may ask for in the coming session.

Nelson.—The working of the light railways undertaking for the year ending March 31st last, has resulted in a deficit of £61, which compares with an estimated deficit of £352. The returns show that 2,035,300 passengers were carried, being an increase on the previous year, although the car mileage 203,203 is a reduction on that period.

Newport.—The past year's working of the tramway has resulted in a revenue of £33,388; working expenses amounted to £22,119; and financial charges totalled £9,027, thus leaving a surplus of £2,243. The adverse balance on the tramways up to March, 1906, and certain other payments have still to be considered.

Nottingham.—During the financial year just closed 31 million passengers were carried on the municipal tramways. The receipts were £139,000, and, after meeting all capital charges, £17,000 has been contributed in relief of the rates. The profit on the working of the electricity undertaking is £45,000, of which it is proposed to devote £10,000 in relief of rates.

Portsdown and Horndean.—The Light Railway Commissioners have, subject to the confirmation of the B. of T., granted an order for the construction of a light railway from the terminus of the Portsdown and Horndean system to Catherington.

Prestwich.—Particulars of the leasing of the tramways to the Salford Corporation by the U.D.C. appear in the *London Gazette* of June 14th.

Southwold.—The Light Railway Co. has applied to the B. of T. for an extension of time for completing the works under the Light Railway Order, 1907.

Sunderland.—At a meeting of the T.C. on the 12th inst., Mr. George New presented the annual report of the Tramways Committee, a digest of which has already been given in our columns. In doing so Mr. New complained that the Tramways Committee had to pay more than many other Corporations for its electrical energy. The Electricity Committee charged it 1 11/16d. per unit, against 1½d. at Wolverhampton and other places. Mr. W. Sanderson said if the Tramways Department was allowed to produce its own electrical energy it would, he had been assured, be able to produce it at a trifle less than 1d. per unit. Alderman Bruce, Chairman of the Electricity Committee, said his committee had again and again reduced the price of energy for the tramways; it had to provide special machines for this particular service; he did not believe other towns which charged less than Sunderland had properly gone into the cost of supplying energy for the tramway service, and the Sunderland Electricity Committee was not going to carry on its business in that way.

U.S.A.—The Chicago, Lake Shore and South Bend Railway is equipping 70 miles of route on the Westinghouse single-phase system. A power house, containing three 3,000-H.P. Westinghouse turbo-generators, will be erected for operating the line; and some 31 cars, each equipped with four 100-H.P. A.C. single-phase motors and multiple-unit control, will deal with the traffic.

Wolverhampton.—The Tramways Committee of the Corporation last week issued an abstract of the accounts respecting the working of the tramways for the year ended March 31st. The Committee state that the following results have been obtained: Total income, £43,822; less expenditure (exclusive of renewals), £24,537; making a gross profit of £19,285. This sum of £19,285 has been dealt with as follows: Contribution to renewals fund, £5,300; instalment of interest, £7,742; repayment of loans, £4,129; leaving a net profit of £2,114.

Yarmouth.—The gross revenue on the year's working of the tramways amounted to £21,902, and the gross profit to £7,631. After meeting financial charges, &c., and including £252 brought forward, a surplus of £2,545 remained, out of which £1,000 was voted to the rates and £1,500 to renewals, &c.

TELEGRAPH and TELEPHONE NOTES.

Telegraphic Interruptions and Repairs:—

		Interrupted.	Repaired.
Cables.			
Cayenne-Pinheiro		Aug. 13, 1903 ..	..
Curacao-Coro Curacao-La Guayra Curacao-Maracaibo	Closed..	Jan. 12, 1906 ..	..
Reissa-Issa and Reissa-Yemani (Yemen)		Oct. 22, 1902 ..	..
Tarifa-Tangier		Jan. 18, 1904 ..	..
Port Arthur-Chifu (Closed)		Mar. 9, 1904 ..	..
Garachico-Santa Cruz		July 12, 1906 ..	..
Las Palmas-Arecife		Aug. 18, 1906 ..	..
Trinidad-Demerara		June 17, 1907 ..	..
Landlines.			
Puerto-Barrios		Aug. 2, 1902 ..	..

Wireless Telegraphy.—The Amalgamated Radio-Telegraphic Company, which owns the patent rights of the Poulsen system, has obtained a site on the coast of Kerry at Knockroe, near Ardfert, and is erecting a trans-Atlantic signalling station. The site is eleven miles from the town of Tralee, and a few miles north of Valentia Island, where the Atlantic cable companies have their stations.

The Arc Works Club.—In spite of the unfavourable weather, from which Messrs. Crompton & Co. seem to suffer three years out of four, on the occasion of their annual sports and inspection of the works, a numerous party of guests went down to Chelmsford last Saturday; and as the rain held off most of the afternoon, the races were carried out most successfully and with evident enthusiasm on the part of both competitors and spectators. At the lunch which as usual intervened between the inspection of the works and the visit to the racecourse, the old question between the Mayor and the company was revived in a new form. It appears that since Messrs. Crompton moved to Writtle, the ambition of that rural district has been aroused, and its rates are even higher than those in Chelmsford. Consequently the company is not now indisposed to be included once more within the borough boundary, and only appeals to the Mayor to be merciful as he is powerful. In his reply for the visitors, the Mayor disclaimed all responsibility for the rise in the rates, which was made by the rural district council. Colonel Crompton, in a happy speech, explained the patriarchal relation between himself and his workmen. "Our men marry and we employ their children"; consequently, the supply of labour increases slowly but surely.

THE FRINDSBURY PLANT OF THE KENT ELECTRIC POWER CO.

With the recent placing in operation of the Kent Power Co's. generating plant of Frindsbury, yet another of the numerous British Power Companies commences the business of supply.

Fig. 1.—Exterior of the Kent Power Co.'s Frindsbury Station, showing Local Cement Works and the River Medway.

The company's powers date from 1902, and its area of some 1,500 sq. miles embraces the whole of the county of Kent, with the exception of the Isle of Thanet. Not unlike a very successful undertaking of the same kind in the North of England, the Kent Co.'s first power station stands on a busy waterway—the River Medway, which, together with the neighbourhood, is best known as the centre of England's cement-making industry; a good idea of the situation of the station is obtained from fig. 1. Similarly also, the company commences operations with an established connection, viz., the Chatham, Rochester and District Electric Lighting Co.'s undertaking, which was acquired as from the 1st of this year, and which last year absorbed 370,000 units for lighting and power. While cement making is an industry, which offers exceptional possibilities for power applications

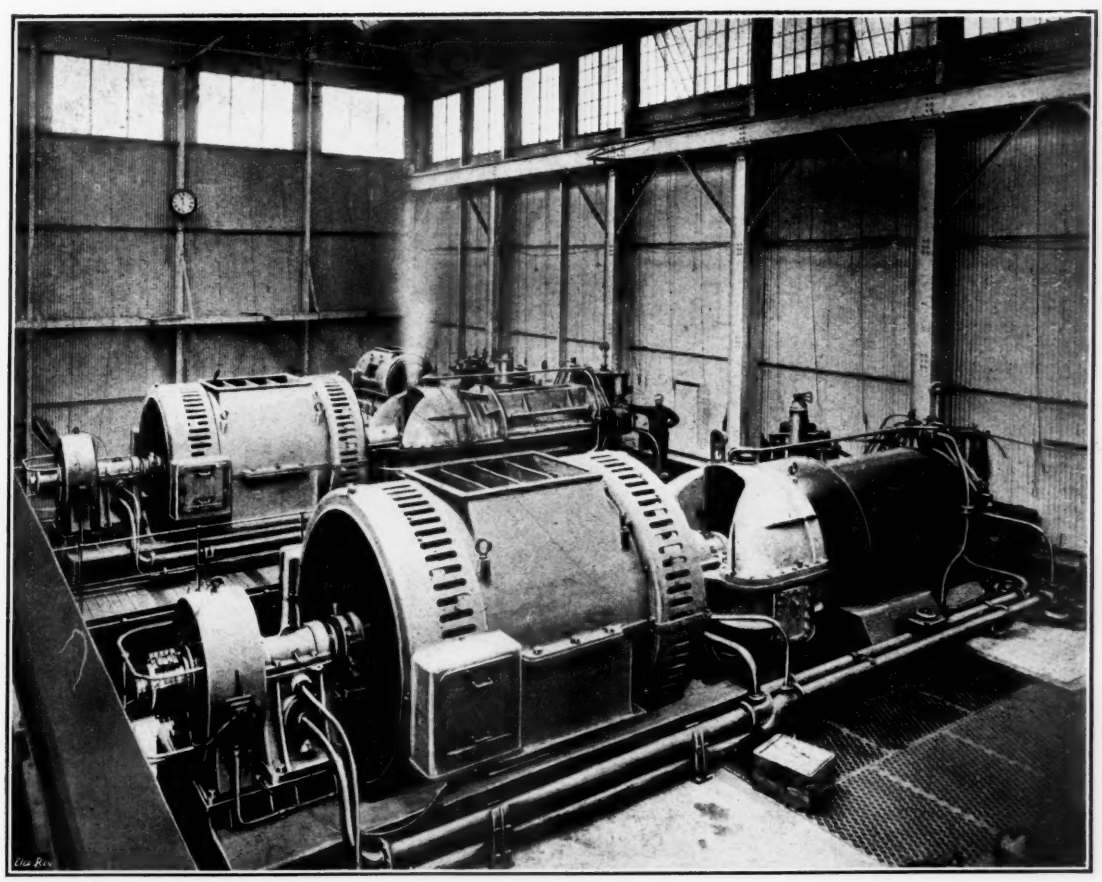


Fig. 2.—Interior of the Engine Room from the Switch-Gallery, 1,500-kw. Units in the Foreground.

(see Electrical Review of May 17th last), it is satisfactory to note that engineering and other industries are all well represented in the district, which judging from experience in other directions, should in time reward the enterprise of the company.

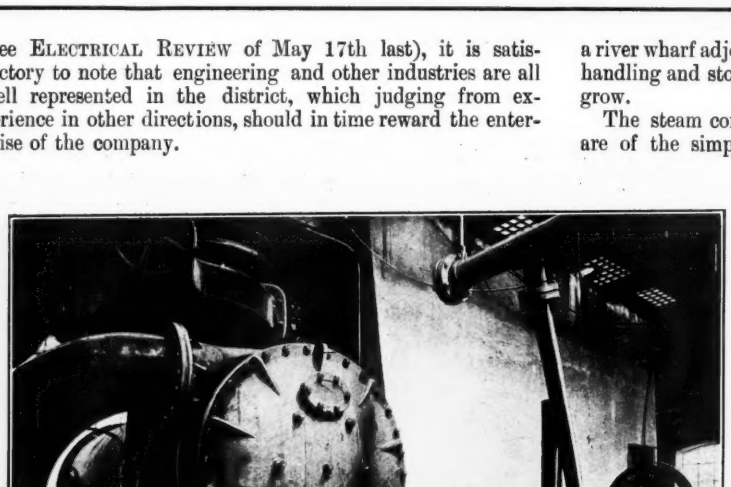


Fig. 3.—View of Parsons' Surface Condensing Plant for 1,500-kw. Turbine Unit.

The Frindsbury station is a plain steel frame structure, sheathed in corrugated metal for the most part, but with brick and concrete switch galleries; a construction which appears to be admirably adapted for the purpose, and to facilitate extension in any direction. The boiler-house contains an initial installation, consisting of two Babcock and Wilcox boilers, each fitted with internal superheaters and chain grate stokers. A view of the boiler plant at present installed is shown in fig. 9.

Each boiler has a rated evaporation of 16,000 lb. of water per hour, at 160 lb. pressure.

The boiler feed, other than that drawn from the hot wells, is obtained from the public mains, and treated in a Guttmann type water-softener, situated over a feed-tank, into which also all the station steam traps discharge. Two Worthington duplex steam-driven pumps, of the horizontal type, are installed for boiler feeding purposes. The flue gases at present discharge direct to an iron chimney, 160 ft. high and 8 ft. 6 in. diameter, but space is allowed behind the boilers for installing a suitable economiser, and the boilers are shortly to be added to.

The coaling arrangements are at present incomplete, but fuel will eventually be obtained from barges lying alongside a river wharf adjoining the site, and will be dealt with by coal-handling and storage plant as the requirements of the station grow.

The steam connections between boilers and prime movers are of the simplest character, consisting merely of boiler branches leading into a header in the boiler-house, sectioned by means of valves, and with other branches leading to the turbines.

The turbo-generating plant installed consists of two 1,500 kw. units, delivering three-phase current at 11,000 volts pressure and 50 cycles, also a smaller two-pole 500-kw. unit of similar periodicity, supplying 2,500-volt three-phase current, this latter machine having been removed from the Whittaker Street station of the Chatham Company, recently destroyed by fire.

The speed of the large units is 1,500 r.p.m., and of the small one 3,000 r.p.m.; in each case the exciter is mounted on an extension of the alternator shaft.

The 1,500-kw. turbo-alternators, views of which are given in figs. 2 and 4, are of Messrs. Parsons' well-known type, having the armature windings so arranged that the stator can be split horizontally, with a view to facilitating access to the rotor. Natural ventilation is relied on, the air being drawn in at each end of the rotor and discharged through an aperture in the top of the stator casing.

The temperature rise of these plants was very small under test, being only 36° F. after three hours' run at full load, and 60° F. after three hours' run at 50 per cent. overload.

The terminals are brought out at each side of the stator into a terminal box, and are easily accessible when it is desired to dismantle the stator. The end windings are specially arranged and secured with a view to obviating any danger from short-circuits, and the cast-iron protecting shields shown in our views are removable in case any repairs are required.

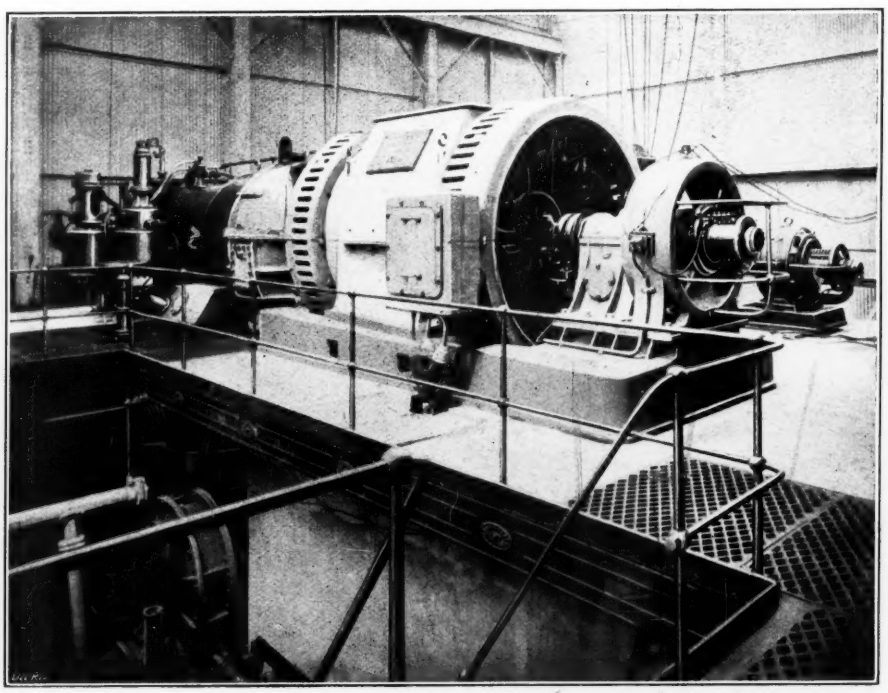


Fig. 4.—Parsons' 1,500-kw. 11,000-volt Turbo-generator.

The excitation pressure for these machines is 45 volts;

they are designed to carry an overload of 50 per cent. for three hours and 100 per cent. for half-hour.

Each turbo-generator is provided with its own surface-condensing plant, vacuum augmenters being also fitted.

Our views, figs. 3 and 8, show the compact arrangement of the plant; the turbine, as usual, exhausting directly into the condenser below, from which again three-throw air pumps, gear-driven by 16-H.P. Phœnix motors in the two larger plants, and by a similar 10-H.P. motor in the smaller one, draw the condensed steam and vapour.

A small force pump attached to the air pumps delivers the hot well water to the feed tank in the boiler house.

The condenser circulating plant is placed in a pit in the basement below the switch galleries. Two 65-H.P. Phœnix motors each operate a Worthington centrifugal pump, with a capacity of 3,500 gals. per minute at 720 R.P.M., for supplying circulating water from a reservoir, adjacent to the station and provided with spray coolers.

A small centrifugal pump operated by a 2-H.P. motor is also provided; this draws from a well, and delivers through the oil coolers of the turbines to the reservoir, thus making good any loss in circulating water. With a further extension of generating plant it is intended to draw upon the Medway for circulating water.

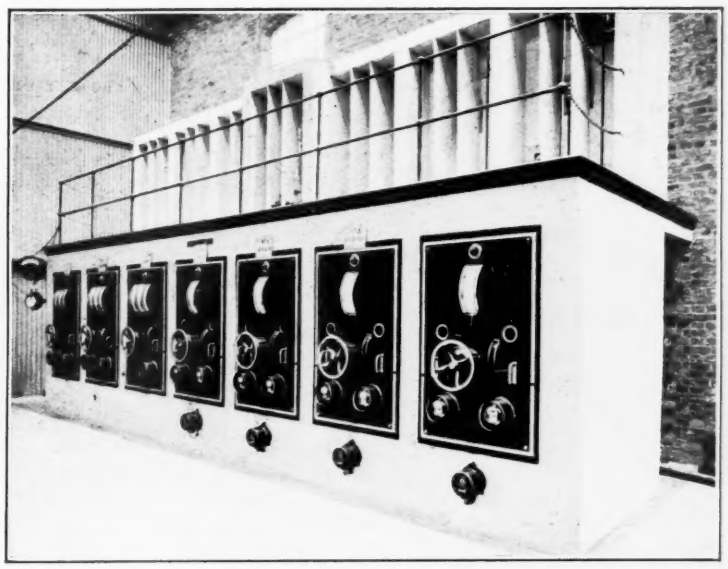


FIG. 5.—GENERAL VIEW OF THE 11,000-VOLT 3-PHASE SWITCH PANELS, WITH MASONRY CELLS BEHIND.

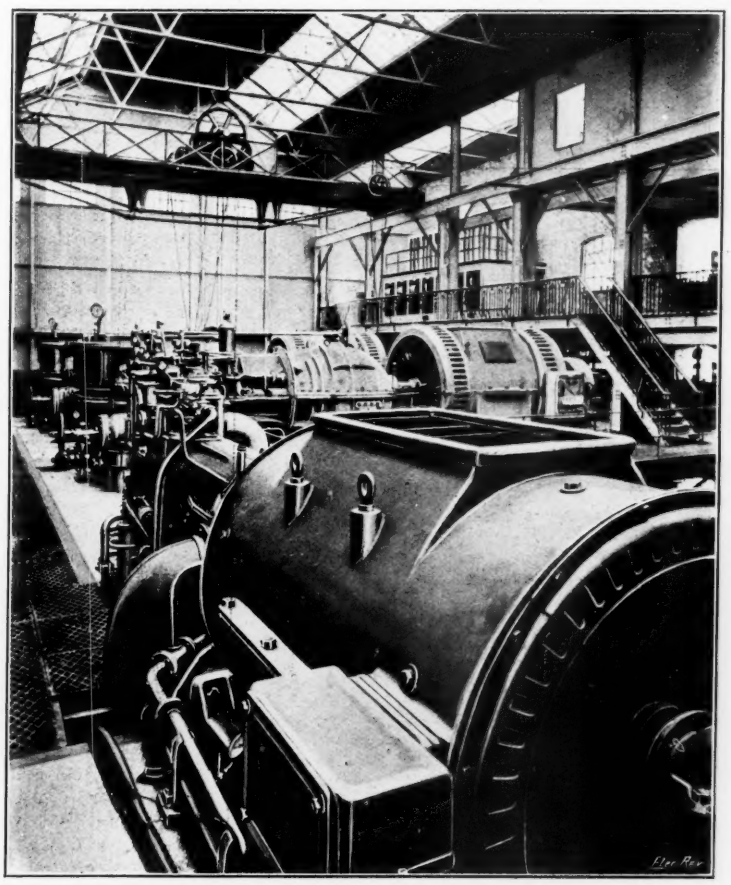


FIG. 6.—VIEW OF ENGINE ROOM, WITH THE 500-KW. UNIT IN THE FOREGROUND.

In connection with each condensing plant, an automatic valve provides an alternative emergency exhaust to atmosphere. At present the station plant is incomplete, as it is intended to instal a battery as a stand-by for excitation and station lighting, and a Phœnix motor-generator is being installed to work in conjunction with the battery. The motor portion of the motor-generator operates, in common with the other auxiliaries, on a three-phase station circuit at 400-440 volts pressure, and is coupled to a 60-KW. D.C. generator, giving 500 amperes at 40 to 120 volts, the latter machine being of the inter-pole type with ventilated field windings.

The H.T. switchgear shown in fig. 5, which is installed on a gallery overlooking the engine room, was, together with the auxiliary switchboard for controlling the station lighting, power and excitation (situated under the H.T. switch gallery), supplied by the Electrical Co.

The H.T. gear is similar in design to that described by us in connection with the Aberdare Colliery installation (ELECTRICAL REVIEW, April 20th, 1906).

The board at present consists of three machine and four feeder panels; the machine panels are each fitted with an ammeter, voltmeter and wattmeter of the edgewise type, and a wheel for operating a 200-ampere tank oil switch behind, also synchronising plugs, &c.; on each feeder panel there is an ammeter, an operating wheel for a 200-ampere feeder oil-switch, &c. In both cases the oil switches are controlled automatically, combined maximum and reverse-current time relays being fitted in the former and maximum-current time relays in the latter case.

The front of each panel subtends a frame carriage mounted on small wheels, which carries the oil switch and accompanying gear and is provided with rear contacts; this carriage and panel can be run forward from its cell on to a trolley provided for the purpose, when repairs or inspection of its contents are necessary, or it may be partly run forward when not in use; in either

case the oil switch wheel on the front of the panel must be turned to the "off" position in order to unlock the carriage before moving it.

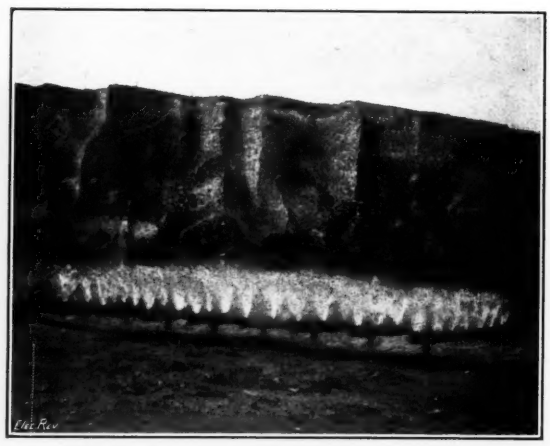


Fig. 7.—The Spray Cooler in Action.

All the switches and bus-bars are enclosed in concrete cells, the bus-bars being arranged over the switchgear. The board is designed with a view to connecting overhead circuits if desired.

Control pillars situated in front of each generator panel provide for field regulation, the rheostats being fixed under the gallery, behind the auxiliary board.

The latter is arranged to control all the three-phase motors in the station with energy at 400 volts pressure, supplied through a 200-kw. Berry oil-cooled transformer; it also provides for the control of the battery and exciters.

At the present time the larger generators are supplying energy through a 600-kw. Berry oil-cooled transformer, which steps down the pressure to 2,500 volts for the Rochester and Chatham network, the smaller generator, of course, supplying direct; but supply at 11,000 volts will be given shortly.

Three-core paper-insulated and lead-covered cables of Messrs. Henley's make, and drawn into Sykes conduits, are provided for supplying the sub-stations in this area at 11,000 volts, when the necessary sub-station plant has been installed.

The company's station is situated in the midst of an industrial area comprising Chatham and Rochester with a population of 70,000 in their immediate neighbourhood, Sittingbourne with its brickfields, the Medway valley to Maidstone, the chief seat of the Portland cement industries, and a portion of the south bank of the Thames. Besides the energy required for lighting there is about 30,000 h.p. employed in works within a moderate distance of the company's station.

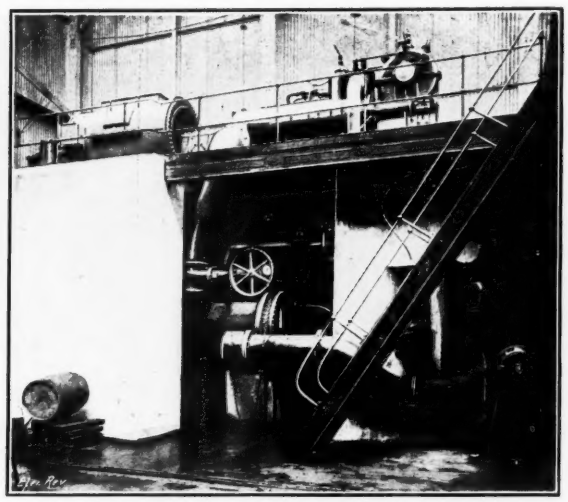


Fig. 8.—View of the 500-kw. Turbine Unit and Condensing Plant.

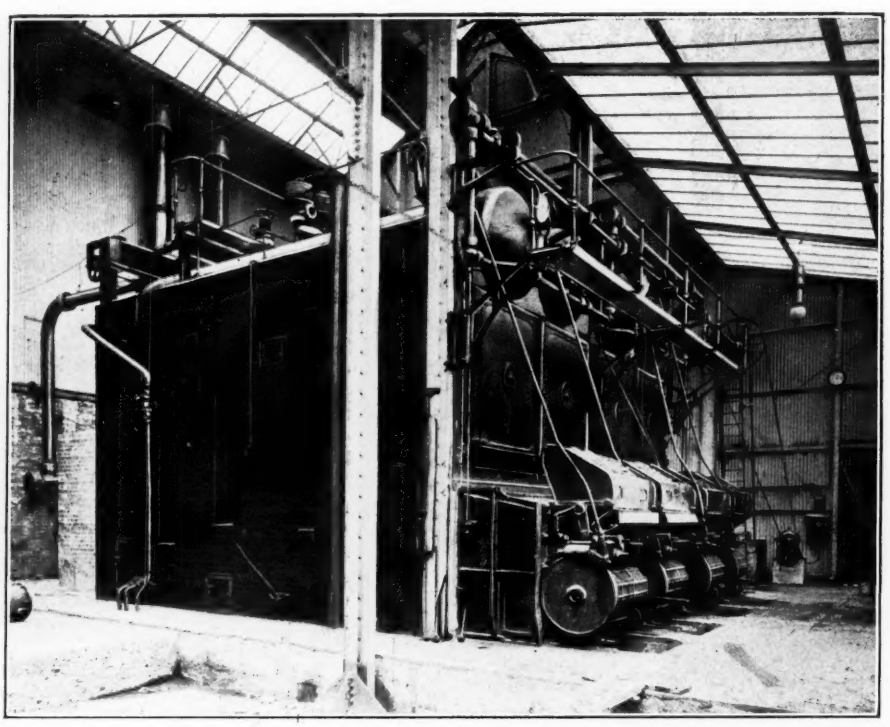


Fig. 9.—View of the Boiler Plant.

There are at present connected or being connected to the mains the lighting of Chatham and Rochester, taking about 500 kw., Messrs. Cory & Son, coal merchants, 220 kw., Messrs. Aveling and Porter, 120 kw., with prospects of large increase, the Medway Steel Works, 70 kw., besides small consumers. The company is also in negotiation with a large number of other prospective consumers. A feature of the district is the number of power consumers within a very moderate distance of the station.

Messrs. G. L. Addenbrooke and A. A. C. Swinton are consulting engineers to the company, and we are indebted to them and to the officials of the company for facilitating the production of this article.

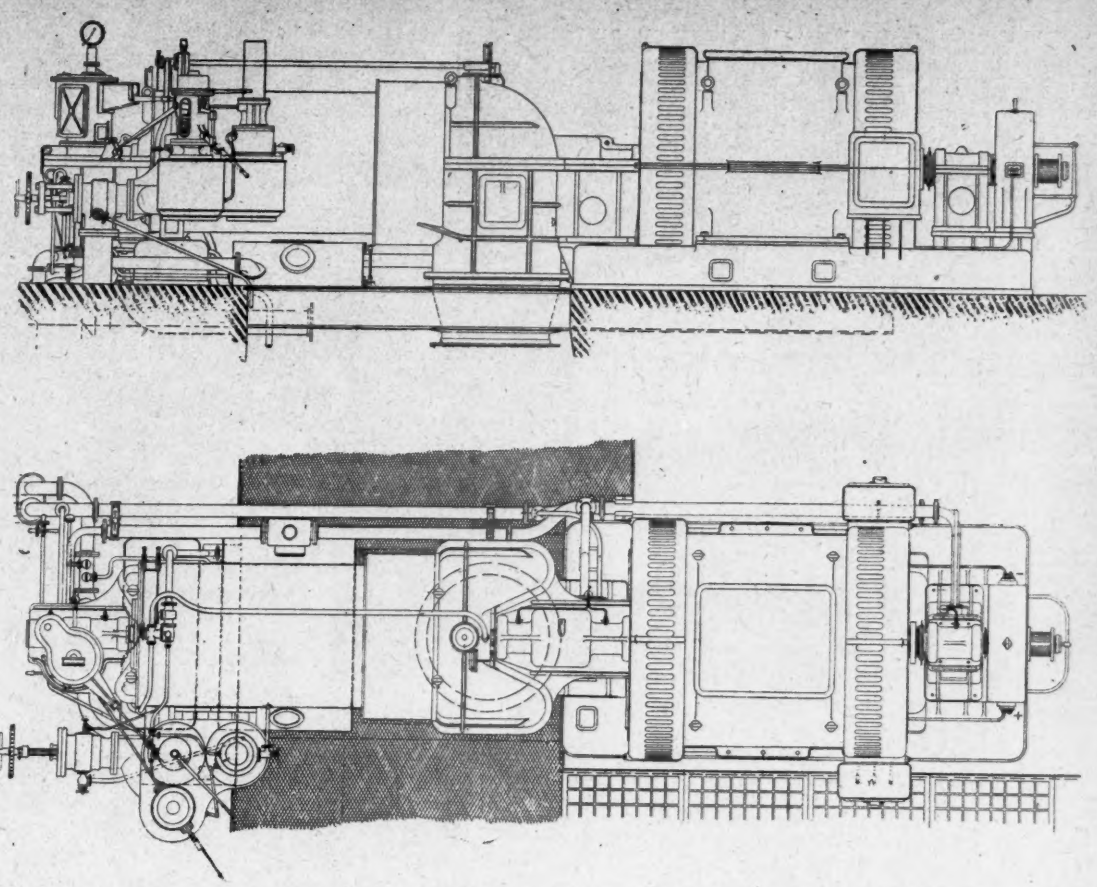


FIG. 10.—ELEVATION AND PLAN OF 1,500-KW. 11,000-VOLT PARSONS' TURBO-GENERATOR AT THE FRINDSBURY STATION OF THE KENT ELECTRIC POWER CO.

CONTRACTORS' COLUMN.

OPENINGS FOR NEW BUSINESS.

ACCRINGTON.—Important extensions to mills for the Belgrave Manufacturing Co.

ATHERTON (LANCS.).—Large spinning mill for the Atherton Cotton Spinning Co.

AYLESBURY (BUCKS.).—Congregational Sunday Schools (£2,500). Roland Plumbe, architect, London.

BATH.—Institute in connection with Manver's Street Baptist Church (£3,000).

BEDLINGTON (NORTHUMBERLAND).—New colliery at Boomersund, near Sleekburn, for the Bedlington Coal Co.

BELFAST.—New R.C. Chapel, Clonnard, Falls Road. J. J. M'Donnell, architect.

BIRKDALE.—New premises for the Bank of Liverpool, Ltd. Jas. Strong, architect, 11, Dale Street, Liverpool.

BLACKBURN.—Proposed extensions to mills. Ward St. Mill Co.

BOLTON.—Important extensions to Manchester and County Bank in Deansgate. A. J. Murgatroyd, architect, Bolton.

Spinning mill (£80,000). Bradshaw & Glass, Bolton, architects.

Laundry to be built at Fishpool Workhouse. Two new Lancashire boilers also required. Mr. Cooper, clerk to Board of Guardians, Bolton.

New spinning mill for the Croall Spinning Co., Ltd.

CAMBRIDGE.—County Girls' School (£9,544). Kerridge & Shaw, builders, Sturton Street, Cambridge; Mr. Cash, architect.

CARDIFF.—Conversion of King's Theatre into music hall (£4,000). Blandon Blake, Cardiff.

CLITHEROE (SABDEN).—New spinning and weaving mill for J. Stuttard & Sons, Manchester.

COWES (ISLE OF WIGHT).—County schools (£8,185). J. Ball & Son, builders, Victoria Road, Cowes, I.W.

CROSSGATES (NEAR LEEDS).—Recreation hall. C. Finnerty, New Manston.

DONCASTER.—Five shops for the T.C. R. A. H. Tovey, town clerk, 1, Priory Place, Doncaster.

DUNDEE.—Auction hall in Ward Road. Robt. Curr, owner.

House and motor shed for Mr. H. Walker.

DUDLEY.—New Primitive Methodist Chapel. H. Harper, architect, Nottingham.

FERRY HILL (Co. DURHAM).—Licensed premises for the N.E. Breweries, Ltd. Thos. H. Murray, architect, Consett.

FORFAR.—Additions to Academy. T. R. Lutar, architect.

GLASGOW.—Extension to the Royal Infirmary (£37,400).

HUDDERSFIELD (LONGWOOD).—Weaving sheds, &c. Lunn & Kaye, architects, Milnsbridge and Huddersfield.

(MILNSBRIDGE).—Club premises for the Milnsbridge County Working Men's Club and Institute. J. Ainley, architect, Chapel Street, Slaithwaite (Yorks).

(HILLHOUSE).—Higher elementary schools. K. F. Campbell, borough architect, 1, Peel Street, Huddersfield.

HULL.—Junior School (Stepney Lane). J. H. Hirst, city architect, Town Hall, Hull.

KILBURN.—Shops. G. A. Sexton, 42, High Road, architect.

KINGSTON-ON-THAMES.—New telephone exchange. J. Rutherford, H.M. Office of Works, Storey's Gate, S.W.

LEEDS.—Block of warehouse premises. Thos. Winn & Sons, architects, 84, Albion Street, Leeds.

Electric light and electric motor for blowing organ to be installed at the Parish Church (£1,500). Dr. Bickersteth, vicar.

LONDON (STAMFORD HILL).—Houses. E. H. Evans, 32, Craven Street, Strand, architect.

(LEWISHAM).—Rebuilding "Black Bull" public house. W. Nash, High Street, Lewisham, builder.

KNIGHTSBRIDGE.—Flats. Perry & Co., Tredegar Works, Bow, E., builders.

WANDSWORTH.—Alterations and additions to Anglo-American Laundry. W. & C. Brown, 7, Ebury Street, S.W., builders.

BERMONDSEY.—Leather factory. J. Greenwood, Ltd., 10, Arthur Street West, E.C., builders.

BERMONDSEY.—Coal store. Ellington & Woodall, 9, Bridge Street, S.W., engineers.

KENSINGTON, N.—"Clifford's Inn" (a temperance public house), to be erected in connection with Westbourne Park Chapel.

HOMERTON, N.E.—Shops. R. S. Wilkinson, 38, Great James Street, W.C., architect.

LONDON FIELDS, E.—Rebuilding offices for Lowe & Co., woollen manufacturers, 11, Golden Square, W.

FINSBURY.—Warehouse. J. Groom, 3, Broad Street Buildings, E.C., architect.

STAMFORD HILL.—Garage for London General Omnibus Co.

GRACECHURCH STREET, E.C.—Rebuilding London and South-Western Bank (£12,000).

LUTON.—Goods sheds and stables for Midland Railway Co. Engineer's Office, Derby Station.

LYTHAM.—Municipal slaughter houses to be built by the U.D.C. (£2,494).

MANCHESTER (ASTLEY).—New colliery to be opened in the district.

(PENDLEBURY).—Works (electrically equipped) to be built for Baxendale & Co., lead manufacturers, Manchester.

(WATERFOOT).—Secondary school for Bacup and Rawtenstall T.C.'s (£25,000).

Development of Sedgley Park Estate, Prestwich, for villa residences. H. C. McCulloch, architect, Wellington Chambers, Victoria Street, Manchester.

MIDDLESBROUGH (HAVERTON HILL).—Electrically-equipped steel works. British Chilled Roll and Engineering Co., Birmingham, owners.

MORRISTON (GLAMORGAN).—Welsh Baptist Church (£4,000). H. A. Ellis, architect, Swansea; Thomas & Jones, builders, Slate Street, Morriston.

OSSETT (YORKS).—Mill for A. & W. Townend. W. Hunstock & Son, architects, Batley.

PERTH.—Block of buildings in York Place. G. Narshall, architect, Perth.

New motor garage for James McFarlane, motor and cycle agent, in King Street.

RADCLIFFE (LANCS.).—Large weaving shed for the Radcliffe Loom and Power Co.

RAMSBOTTOM (LANCS.).—Print works for the Woodhey Printing and Dyeing Co., Holcombe Brook, Ramsbottom.

ST. ALBANS.—High school for girls.

SMETHWICK.—Technical and secondary schools (£9,000). F. J. Gill, architects, 236, Rolfe Street, Smethwick, Birmingham.

SOUTHEND-ON-SEA.—Baptist Hall, &c. (£1,100). S. Comber, architect, Southend; Smith & Chambers, builders, Southend.

STIRLING.—New municipal buildings (£12,000). Plans invited. W. Leiper, Glasgow, to act as assessor.

STOKE-ON-TRENT (WHISTON).—Primitive Methodist Church and schools. Ford & Slater, architects, Burslem.

STOURBRIDGE.—Extensive additions to the Grammar School. A. H. Guest, builder, Wollaston, Stourbridge.

SWANSEA.—Parish hall for Christ Church. W. Cousins & Son, architects, 168, St. Helen's Road, Swansea.

Rebuilding the Star Theatre (£15,000).

SWINDON.—Primitive Methodist Mission Hall (£1,000). G. Kilminster, builder, William Street, Swindon.

WARRINGTON (SANKEY).—New police station. H. Littler, county architect, 16, Ribblesdale Place, Preston.

New Council School, Latchford. Garnett & Wright, architects, Warrington.

WREXHAM.—Board room and offices for the R.D.C. J. Oswell Bury, clerk, 8, Temple Row, Wrexham.

CONTRACTS OPEN and CLOSED.

OPEN.

Adelaide (S.A.).—July 10th. The Postmaster-General requires tenders for 5 miles of insulated copper wire, two switchboards, two lightning arrester boards, 500 No. 2 Leclanché cells, 12 differential galvanometers, 15 electromagnetic transmitters, six plug pattern registering boxes, 500 copper tapes, 5,000 copper binders. Particulars may be obtained at the Commonwealth Offices, 72, Victoria Street, Westminster.

July 31st. The Deputy Postmaster-General at Adelaide is inviting tenders for a considerable quantity of telegraph and telephone apparatus and material, a full list of which appears in the *Board of Trade Journal* for last week.

Belgium.—The municipal authorities of Ans, near Liége, are at present inviting tenders for the concession for the private and public electric lighting of the town, and for the supply of electrical energy for power purposes.

Bolton.—The Electricity Committee requires from 10,000 to 15,000 tons of bituminous engine slack, to be delivered in quantities up to 100 tons per day.

Darlington.—Steam and exhaust pipes. See "Official Notices" June 7th.

Eastbourne.—June 29th. Supply and erection of water-tube boiler, steam and water piping, for the T.C. See "Official Notices" June 7th.

For Sale.—Paterson purifier. See "Official Notices" to-day.

Tudor battery, motor-generator and switchboard, at Devonport. See "Official Notices" to-day.

Gillingham.—June 24th. Coal for the T.C. for 12 months. See "Official Notices" to-day.

L.C.C.—July 9th. Two 5,000-KW. three-phase steam turbo-generators with surface condensers, &c., for East Greenwich tramways generating station. See "Official Notices" June 14th.

London, E.C.—June 24th. Electric light installation for the stage of the Central Club Society, Ltd. See "Official Notices" June 7th.

London.—HACKNEY.—June 27th. Electric light installation for the Central Public Library. See "Official Notices" June 7th.

London.—July 9th. Installation of electric light, bells, telephones and motors for the L.C.C. See "Official Notices" to-day.

Manchester.—Steam piping, superheaters, steam traps, &c., for Messrs. John Collier & Co. See "Official Notices" to-day.

Newport (Mon.).—July 1st. Switchboard, motor alternators, battery, cooling tower, reversible booster, &c., for the Corporation. See "Official Notices" June 14th.

Perth (W.A.).—August 6th. Desiccating apparatus with motor-driven air-pump for telephone cable work for the Deputy Postmaster-General. Specifications at the Commonwealth Office, 72, Victoria Street, S.W.

Pontypridd.—July 8th. To supply and lay 3,000 yards of triple-concentric paper-insulated cables. See "Official Notices" to-day.

Portsmouth.—June 24th. Supply and erection of 1,000-KW. turbo-alternator, with condensing plant and accessories, for the T.C. See "Official Notices" June 7th.

Servia.—June 28th. The municipal authorities of Schabatz are inviting tenders until the 28th inst. for the establishment of a central electric lighting station in the town.

South Shields.—June 22nd. Stores for the Corporation tramways department. See "Official Notices" June 14th.

Spain.—Tenders have just been invited by the municipal authorities of Salvatierra de los Barros (province of Badajoz) for the concession for the electric lighting of the town.

Spain.—June 30th. Tenders are being invited until the 30th inst. for the construction of an electric tramway in the town of San Sebastian.

Stepney.—July 1st. Meters, demand indicators and arc lamp carbons for the Electricity Committee. See "Official Notices" June 14th.

Sydney (N.S.W.).—August 14th. The Deputy Postmaster-General is inviting tenders for telegraph, telephone and electric light material.

Tasmania.—July 29th. Telephone subscriber service meters, racks, and cable for the Deputy Postmaster-General at Hobart. General and special conditions, &c., can be seen at the General Post Offices at Hobart, Sydney, Melbourne, Brisbane, Adelaide and Perth.

Victoria.—July 16th. The Deputy Postmaster-General requires tenders for cable, switchboards, telephones, and various telephone and telegraph apparatus. Detailed specifications may be seen at the office of the officer representing the Commonwealth of Australia in London, Captain Collins, C.M.G., 72, Victoria Street, Westminster, S.W.

CLOSED.

Antwerp.—The Compagnie Electrique Anversoise, Anvers, have accepted the tender of Messrs. Ed. Bennis & Co., Ltd., Bolton, for the following:—Complete coal elevating, automatic weighing and conveying plant, 35,855 fr., for their power station at Quai Cockerill, Antwerp,

Bolton.—The Corporation has accepted the tender of Messrs. Bennis & Co., Ltd., of Bolton, for complete coal and ash handling plant for the boiler extensions, together with four Bennis stokers and compressed-air furnaces, at £1,350.

Bolton.—The Electricity Committee has recommended the acceptance of Messrs. Musgrave & Sons' tender for a 2,000-H.P. vertical steam engine, and that of Messrs. Dick, Kerr & Co., for a three-phase alternator.

Blackburn.—The Corporation has placed the contract for the supply of D.C. motors for the ensuing 12 months, with Messrs. Newtons, Ltd., of Taunton.

Croydon.—The B.C. has accepted the tender of Messrs. Harding, Churton & Co., at £178, for a motor and pump capable of delivering 50,000 gallons per hour.

India.—Messrs. W. H. Bailey & Co., Ltd., of Salford, have just received a repeat order from the Indian Government for one of their "Davidson" patent double-ram pumping engines, of large size, for railway water supply.

Lanark.—The County Council has accepted the tender of Messrs. Johnson & Phillips, Ltd., for the supply and erection of a 70-KW. motor-generator, battery-charging booster, and switchgear for the Cambuslang electricity works extension.

London.—SHOREDITCH.—The B.C. has accepted the following tenders for the annual supply of coal for the electricity undertaking :—

C. Gothard & Co.—Manners peas nuts, 15s. 2d. per ton.
C. J. Cockerell & Co.—Wollerton nutty slack, 13s. 11d. per ton.

Twenty firms were invited to send in tenders, and of these six complied with the request.

London.—The Highways Committee of the L.C.C. has received the undernoted tenders for: (1) high tension cables; (2) 400,000 cable ducts and (3) electrically operated car traversers for the Holloway and Hackney tramway sheds :—

1.—HIGH TENSION CABLES.

	£	s.	d.
Siemens Brothers & Co. (recommended)	70,563	9	7
Western Electric Co.	71,710	2	1
British Insulated and Helsby Cables	72,406	3	0
Callender's Cable and Construction Co.	73,577	1	2
W. T. Glover & Co.	73,694	11	4
W. T. Henley's Telegraph Works	74,521	15	2
Johnson & Phillips	74,598	2	8
St. Helens Cable and Rubber Co.	76,346	5	6

2.—STONEWARE CABLE DUCTS.

	Numbers tendered for.	Rate per 1,000.	Amount including provisional sum of £10 for contingencies.
Stanley Bros. (recommended) ..	400,000	£11 0 0	£4,500 0 0
Gibbs & Canning	100,000	11 15 0	1,275 0 0
George Skey & Co.	160,000	11 17 6	2,000 0 0
James Woodward, Ltd.	400,000	12 0 0	4,900 0 0
Hosea Tugby & Co.	400,000	12 9 6	5,090 0 0
H. R. Mansfield	400,000	12 9 6	5,090 0 0
Robinson & Dowler	200,000	12 10 0	2,600 0 0
Sutton & Co.	200,000	12 10 0	2,600 0 0
Donington Sanitary Pipe Co.	100,000	13 15 0	1,475 0 0
Doulton & Co.	200,000	14 0 0	2,900 0 0
Ensor & Co.	100,000	15 0 0	1,600 0 0
Thomas Wragg & Son	400,000	15 0 0	6,100 0 0
George Jennings	100,000	15 0 0	1,600 0 0
Leeds Fire Clay Co.	200,000	16 17 6	3,475 0 0

3.—ELECTRICAL CAR TRAVERSERS.

S. H. Heywood	£3,600
Heenan & Froude (recommended)	3,675
Mountain & Gibson	4,173
Appleby's, Ltd.	4,560
Adamson, Ramsbottom & Co.	5,250

The figures given relate to the supply of five traversers without capstan gear. Alternative tenders were also submitted for five traversers with capstan gear.

The Education Committee of the L.C.C. has received the following tenders for the installation of arc and incandescent lamps, bells, telephones, and lightning conductors at the L.C.C. Technical Institute, Westminster :—

J. Bryden & Sons (recommended)	£687
Pinching & Walton	761
Aberdeen Electrical Engineering Co.	856
J. Barker & Co.	944
S. G. Cozens	966
Mercer, Rance & Co.	1,050

Loughborough.—The T.C. has accepted the tender of Messrs. Manlove, Alliott & Co. for a refuse destructor, at £1,362.

Luton.—The T.C. has accepted the following tenders :—

Lancashire boiler.—Messrs. Ruston, Proctor & Co., Lincoln, £784.
Condensing plant.—Worthington Pump Co., London, £664.
Coal bunkers, elevator and conveyors.—Messrs. R. H. Longbotham & Co., Wakefield, £674.

Mardy.—The Mardy Electric Light Co., Ltd., have secured the contract from the Rhondda U.D.C. for lighting the whole of the streets of Mardy with 23-c.p. tantalum lamps as per their lighting time table, for £3 5s. per lamp per annum, and arc lamps on the open spaces to burn until midnight for £12 10s. each lamp per annum. The work has been done on the three-wire system, under the supervision of Mr. W. W. Ross, the company's electrical engineer.

Marylebone.—The B.C. has accepted the following tender for cables :—St. Helens Cable Co., Ltd. (1) 1,320 yards 1 sq. in., £1,381; (2) 880 yards ·25 sq. in., £652; (3) 880 yards ·15 sq. in., £424; (4) 440 yards 1 sq. in., £485; (5) 780 yards 1·5 sq. in., £1,180; (6) 180 yards 1 sq. in., £187; (7) 120 yards 7/18 S.W.G., £5. The Council also received the following tenders for repairs to the old North Street battery (new negative plates, &c.):—Accumulator Industries, Ltd., £1,150; Electrical Power Storage Co., Ltd. (accepted), £1,170.

Positive plates.—Accumulator Industries, Ltd., per 100, £45; Electrical Power Storage Co., Ltd. (accepted), price of first 100, £66; subsequent plates, 9s. 3d. each. To cut to pieces the whole of the positives, so as to clean and examine the boxes and reburn them, £120; to supply new acid, £90.

Salford.—The T.C. has accepted the tender of the Liverpool Electric Cable Co., Ltd., for cables; and those of Watlington & Co. and Mr. John Hall for car accessories.

Walsall.—The T.C. has accepted the tender of Messrs. Babcock & Wilcox, Ltd., for dampers, &c., for new boiler flues, at £18 10s.; that of Messrs. Stewarts & Lloyds, Ltd., for steam and water pipes for the electricity works, at £89 10s.; and that of Messrs. Siemens Bros. & Co., Ltd., for telephone cable, at £11 18s. 9d.

Whitehaven.—The T.C. has accepted the tender of Messrs. Cole, Marchent & Morley for a surface condenser, at £821. The highest tender was £1,339.

Willesden.—The T.C. has accepted the tender of Oliver Arc Lamps, Ltd., at £668, for 66 lamps.

Woolwich.—The B.C. on June 13th received tenders from the following firms to carry out installation work on behalf of the Council in the parishes of Woolwich and Plumstead :—

G. Weston & Sons, 153, Fenchurch Street.—(1) To wiring for six points, with main switches and fuses, cables, wood casing and capping, sub-boards, switches, fuses, plugs, ceiling roses, blocks, complete in every respect (except fittings), £4 10s.; (2) to additional points, 13s. per point; (3) to wiring for six points, with main switches and fuses, cables, screwed steel tubing, sub-boards, fuses, plugs, ceiling roses, blocks, complete in every respect (except fittings), £5 14s.; (4) to additional points, 18s. per point; (5) to supplying and fixing six adjustable pendants consisting as above, together with porcelain or metal counterweight, pulleys and shot, £1 10s.; (6) to additional pendants, 5s. per pendant; (7) additional percentage to cover office, &c., expenses, 20 per cent.

Lonsdale Engineering Co., 27, Chancery Lane.—(1) £2 14s.; (2) 10s.; (3) £3; (4) 11s.; (5) 18s.; (6) 3s.; (7) 5 per cent.

L. J. Allbright, St. Leonards.—(1) £3 15s.; (2) 14s.; (3) £5 2s.; (4) 19s.; (5) £2 8s.; (6) 8s.; (7) 25 per cent.

Charles Ross, Walsall.—(1) £6; (2) 16s.; (3) £6 18s.; (4) 18s. 6d.; (5) £6 18s.; (6) 3s.; (7) 25 per cent.

E. G. Kelsey, Woolwich.—(1) £5 2s.; (2) 15s. 6d.; (3) £6; (4) 19s.; (5) £5 11s.; (6) 17s.; (7) 20 per cent.

Reliance Electrical Co., Duke Street, E.C.—(1) £2 17s.; (2) 9s.; (3) £4 13s.; (4) 15s.; (5) £1 7s.; (6) 4s. 6d.; (7) 15 per cent.

H. J. Godfrey, Balham.—(1) £3 12s.; (2) 11s.; (3) £4 19s.; (4) 15s. 6d.; (5) £1 7s.; (6) 4s. 6d.; (7) 10 per cent.

Word & Newman, Ilford.—(1) £3; (2) 10s. 6d.; (3) £3 12s.; (4) 12s. 6d.; (5) £1 4s.; (6) 4s.; (7) 10 per cent.

E. P. Allam & Co., Clerkenwell (accepted).—(1) £3 15s.; (2) 12s. 6d.; (3) £4 19s.; (4) 16s. 6d.; (5) £1 4s.; (6) 4s.; (7) 10 per cent.

Armstrong Power Co., Ltd., 118-122, Holborn.—(1) £3 12s.; (2) 11s.; (3) £4 10s.; (4) 14s.; (5) £1 8s. 6d.; (6) 4s. 6d.; (7) 33⅓ per cent.

C. J. Wilkin & Son, New Cross.—(1) £3 16s. 6d.; (2) 11s. 9d.; (3) £4 10s.; (4) 14s.; (5) £4 16s.; (6) 15s.; (7) 15 per cent.

C. Larkins & Co., Cannon Street.—(1) £4 1s.; (2) 10s.; (3) £6 6s.; (4) 17s. 6d.; (5) £1 1s.; (6) 3s. 6d; (7) 40 per cent.

Tender on a basis of 3 pairs of lamps installed.—Sowerbutts and Rogers, 17, High Road, Kilburn.—(1) £4 10s.; (2) 15s.; (3) £7 10s.; (4) £1 5s.; (5) £1 1s.; (6) 3s. 6d.; (7) 20 per cent.

FORTHCOMING EVENTS.

Tuesday, June 25th.—At 8 p.m. Faraday Society. Meeting in the Library of the Institution of Electrical Engineers. Papers will be read on "The Thermo-Chemistry of Electrolysis in Relation to the Hydrate Theory of Ionisation," by W. R. Bousfield, M.A., K.C., and T. Martin Lowry, D.Sc.; "The Influence of Non-Electrolytes and Electrolytes on the Solubility of Gases in Water. The Question of Hydrates in Solution," by James C. Philip; "The Dissociation of Hydrates as Indicated by their Equilibrium Curves," by A. Findlay, D.Sc.; "Hydrates in Solution: Discussion of Methods Proposed for Determining Degree of Hydration," by George Senter, Ph.D. The reading of the papers will be followed by a general discussion on "Hydrates in Solution."

Tuesday to Friday, June 25th to 28th.—Meeting of the Incorporated Municipal Electrical Association at Sheffield.

Friday, June 28th.—At 5 p.m. Physical Society of London. Meeting at the City and Guilds' Central Technical College, Exhibition Road, S.W. Agenda: Mr. J. T. Irwin—Demonstration of the uses of his hot-wire oscillographs and hot-wire wattmeters. Mr. J. S. Dow—A cosine flicker photometer, and some phenomena in colour vision. Prof. W. E. Ayrton and Mr. T. Mather—Description and exhibition of students' apparatus for measuring permeability and hysteresis; and design of chokers.

Saturday, June 29th, to July 6th.—Junior Institution of Engineers. Summer meeting in the Clyde District.

NOTES.

Electrolytic Sterilisation of Water in Swimming Baths.—Dr. Samuel Rideal, of the chemical laboratory, Victoria Street, has been permitted by the Westminster City Council, under protective conditions, to carry out experiments on the sterilisation of water at one of the swimming baths by electrolytic chlorine, with the object of ascertaining whether the water need be changed as frequently when kept purified as at present.

Electricity Works Statistics.—DUNDEE.—We are asked to state that the number of units sold during the last year was 4,008,413, not as printed in our Table.

L.C.C. Electric Supply Bill.—On Wednesday, prior to the lunch interval, Mr. Freeman, K.C., placed before the Committee the document which the Council proposed should be embodied in the Bill with respect to the conditions of lease or transfer. These provisions are contained in a schedule to the Act, and may be briefly summarised as follows:—

The transfer is to include the powers as to works and supply, including the power to supply electrical fittings on hire-purchase, &c.

The transferrees are bound to erect generating stations on sites selected or approved by the Council. If the Council acquire the scheduled land at Barking, the transferrees must lease the same at a rent equal to the amount of interest and sinking fund on moneys borrowed for purchase.

System of generation, transformation, and distribution to be subject to the approval of the B. of T., who are also to settle disputes between the Council and the transferrees.

Transferrees to give supply within the time prescribed by the Bill, and to extend stations and distribution system to meet future demands. Transferrees to be subject to the Bill as to supply.

Maximum prices not to exceed those in the Bill (or as revised), and except with consent of Board of Trade supply to authorised distributors only to be given on basis securing supply by such distributors of energy for power at prices not exceeding the maximum prices for the time being authorised under the Act.

Sliding scale of dividend and prices with revision at end of 10 years, afterwards at intervals of 7 years.

Council to receive proportion of surplus profits over an agreed fixed dividend, to be applied for the benefit of ratepayers in the area of supply. Not, it will be noted, London ratepayers only, as was the case last year.

Transferrees to sell to the Council at end of 50 years (afterwards at intervals of 10 years) at the then value of undertaking, or in 1931 (and after at intervals of 10 years) at the then value of the undertaking plus such further consideration as agreed upon or specified in the deed. The then value to be determined.

Institution and Lecture Notes.—Municipal Tramways Association.—We understand that a meeting of the Managers' Section of this Association was held in the Town Hall at Blackpool on Thursday and Friday, June 6th and 7th. Neither the papers nor the discussions are to be published, the proceedings always being more or less private. The official programme included the following papers:—

"Accidents," by Mr. J. Lancaster.
"Transfer Tickets," by Mr. L. Johnston.
"Single Truck and Bogie-Cars," by Mr. J. Dalrymple and Mr. H. Mozley.
"Current Consumption (Meters)," by Mr. C. J. Spencer.
"Air Brakes," by Mr. L. Slattery.
"Corrugation of Rails," by Mr. A. L. C. Fell.
"Observations on Pay and other Allowances to Motormen and Conductors," by Mr. J. B. Hamilton.

Institution of Electrical Engineers (Students).—Particulars are now available of the forthcoming Students' Tour to Switzerland, which commences on Friday, July 5th. The party will proceed first to Zürich, where the Oerlikon Works and the tramway power station will be visited; next to Winterthur, to the works of the Schweizerische Locomotiv und Maschinenfabrik, and Messrs. Sulzer Bros.; Messrs. Escher, Wyss & Co., of Zürich, the Polytechnikum, and the municipal generating station. Travelling *viâ* Lucerne and Interlaken, the visitors will next inspect the Jungfrau railway, and finally will visit the Kander power station of the Burgdorf-Thun electric railway, concluding their tour at Thun on July 13th. It will be seen that the programme follows generally the lines of the memorable tour of 1899. Particulars can be obtained from Mr. E. W. Moss, hon. sec., 20, Huddleston Road, Tufnell Park, London, N.

Royal Society.—Yesterday the Bakerian Lecture was to be delivered by Dr. T. E. Thorpe, C.B., F.R.S., "On the Atomic Weight of Radium." After the lecture a number of papers were down for reading.

Institution of Electrical Engineers' Conversazione.—On Tuesday evening the annual conversazione of the I.E.E. was held at the usual place—the Natural History Museum, South Kensington—and was well attended, there being about 1,500 present. The guests were received by the President and Mrs. Glazebrook, the President-Elect and Lady Kelvin and Members of the Council. The string band of the Royal Engineers performed a programme of music in the Central Hall, and the Alexandra Ladies' Quartette gave a musical entertainment in the Reptilia Gallery, the acuteness of the contrast between the fair performers and their weird surroundings being the subject of many amused comments.

Amongst those present were Lord Justice Buckley, Mr. Justice Grantham, Rear-Admiral Sir H. Jackson, Sir H. C. Mance, Sir W. Crookes, Sir J. Clifton Robinson, Sir William Ramsay, Sir J. I. Thornycroft, Major-General Festing, and Prof. G. Carey Foster, besides many other eminent guests and members. The new Triceratops and Iguanodon shared the honours with the now familiar Diplodocus in the Reptile Gallery, and two new Okapi were also objects of special interest, in addition to the usual attractions of this pleasant gathering.

Institution of Electrical Engineers (Students' Section).—The following are the names of the Committee of the London Students' Section for the coming session:—Messrs. B. A. M. Cooper and F. R. Unwin (C.T.C.); C. E. Abell and C. Garland (Finsbury); A. H. M. Campion (King's); J. A. Maunas-Smith and C. W. Short (Faraday House); Richardson and Rigby (University); J. A. Cook and B. A. Tubini (Extra Collegiate); W. B. Thompson, G. C. Shadwell and G. H. Stevens (hon. sec.)

Appointments Vacant.—Bristol: Two charge engineers (35s. to 55s.) Stockton-on-Tees: Switchboard attendant. Oldham: Junior assistant (£80 to £100). See "Official Notices" to-day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—On Wednesday last week, Mr. F. Sturrock, assistant engineer, Dundee, Broughty Ferry and District Tramway Co., who is shortly going to South Africa, was presented by the employés of the company with a set of gold studs and sleeve links and a silver cigarette case. Mr. J. H. Shepherd, manager, made the presentation.

Mr. Harry Richardson, city electrical engineer, Dundee, has been granted an increase of £100 in salary (making £600 per annum) on the understanding that he will see the new electrical scheme through.

On June 11th, Mr. F. W. Purse, chief assistant engineer to the Warrington Corporation electricity and tramways departments, was married to Rosa, elder daughter of Mr. H. P. C. White, of Penketh. Among the many presents received were a case of silver fish carvers and a barometer from the staff and employés of the electricity and tramways departments.

The chief officers of the Devonport Corporation met together on the 14th inst. for the purpose of presenting to Mr. J. M. Spark, the borough electrical engineer, a silver rose-bowl, on the occasion of his marriage, which was to take place the following day. The rose-bowl was accompanied by an illuminated address.

On Wednesday last week, Mr. A. J. Wray, manager and chief engineer of the Banbury Electricity Works, was married to Miss A. L. Kimberley, daughter of Mr. J. S. Kimberley, of Banbury. A reception followed the ceremony. Amongst the numerous wedding presents was a smoking cabinet from the electricity works staff.

Mr. W. Corin, M.Inst.C.E., has resigned the post of City electrical engineer to the Corporation of Launceston, Tasmania, which he has held for the past 11 years, for the purpose of devoting his attention to his private consulting practice at 7, Hill Street, Launceston, Tasmania.

On the 12th inst. Mr. A. B. Randall, resident engineer and manager of the Salisbury Electric Light and Supply Co., Ltd., was married to Edith, only daughter of the late James Horder, of Salisbury.

On the occasion of his marriage to Miss E. M. Vickers, which took place on Saturday last, Mr. R. M. Carr, chief engineer of the Leek electricity department, was presented with a set of carvers from the staff and employés of the department by Mr. P. Williams, the chief assistant engineer.

Mr. K. N. Saye, who is leaving the service of the South Metropolitan Electric Tramways and Lighting Co., Ltd., to take up an appointment as station supervisor at H.M. Dockyard, Portsmouth, was, on the 13th inst., presented with a smoker's companion by the staff and employés of the Sutton power station, with their best wishes for his future success.

Mr. P. H. Buzza, of Leeds, has been appointed assistant engineer at Colchester Electricity Works out of 229 applicants.

Mr. Harold Halse has been appointed engineer to the Savoy Hotel, Ltd., and has in consequence resigned his position as engineer and manager of the Montrose and Brechin undertakings and secretary to the North of Scotland Electric Light and Power Co., Ltd. There were 718 applicants for the appointment.

Tramway and Railway Officials.—Mr. Pakenham W. Beatty, resident engineer at Golders Green car-sheds, on the occasion of his retirement from the Underground Electric Railways Co., was the recipient of a handsome travelling bag and liqueur case presented by the employés at Lillie Bridge and Golders Green depôts. The presentation took place at Hammersmith, Mr. L. W. Megotti in the chair. The many speeches of the evening bore eloquent testimony to Mr. Beatty's popularity.

Mr. A. C. Hanson, who has been manager of the Stirling Corporation electricity works since their start seven years ago, has resigned, owing to ill-health.

At a smoker at Hightown Hotel on 11th inst., Mr. T. P. Taylor was presented with a gold hunter watch, from the engineers and sub-station staff of the L. & Y. Railway (Liverpool and Southport Electric Railway). He is about to take up a better position in Birmingham.

General.—After the 24th inst., Mr. Claude W. Hill's address will be 9, Queen Anne's Gate, Westminster.

The Plymouth district staff of the National Telephone Co. have presented a silver-plated tea-tray to Mr. P. F. Cubbell, district manager, who is leaving to take up a similar position at Dublin.

A complimentary dinner was given to Mr. J. Metcalfe, of the Bryant Trading Syndicate, Ltd., on Tuesday, June 17th, on the eve of his departure for the United States, at the Holborn Restaurant. A very enjoyable evening was spent, and the company's electric lamp manufacturing department was well represented.

Mr. Alfred E. Garbutt, manager of the cable department of Messrs. I. Frankenburg & Sons, Ltd., Salford, was on the 14th inst., presented with a silver cigarette box and ash tray, suitably inscribed, on the occasion of his leaving the firm.

The officers and staff of the Manx Electric Railway Co., Douglas, have presented a set of army Treider binocular glasses, in case, and a gold watch pendant to Mr. Harold Brown, late chief engineer, who is leaving for Canada.

Mr. Guy Burney (formerly I. B. Birnbaum), manager of the Sterling Telephone and Electric Co., this week formally announces that he has relinquished the use of the names by which he has hitherto been known, and has assumed the names of Guy Burney.

Obituary.—With the deepest regret we have to record the death of Mr. W. E. L. Gaine, solicitor and general manager of the National Telephone Co., on Tuesday last. Mr. Gaine had been suffering from an attack of pleurisy, and the annual dinner of the company was postponed in consequence, in the confident hope that he would be able to take his accustomed place in the chair. Mr. Gaine was born in London in 1851, and for 17 years held the appointment of town clerk of Blackburn, where he was highly esteemed. In 1892 he accepted the position of general manager of the National Telephone Co., which then served about 46,000 subscribers' lines, while the staff numbered about 4,000 in all. Under Mr. Gaine's able management the company, after absorbing several rival concerns, rapidly grew in importance; with the aid of scientific organisation and uniformity of system its operations were extended to cover the whole country, and it became in real earnest a national undertaking, second only in importance as a means of communication to the Post Office itself, and latterly in close alliance with that department. Mr. Gaine's experience and exceptional ability as a solicitor were of immense value to the company in the difficult and delicate negotiations which from time to time were carried on with the Government and other ruling bodies, and it is very largely due to his skill and energy that the company has successfully triumphed over the numerous obstacles which have been placed in its way. Mr. Gaine was untiring in the interests both of the company and of its employés, amongst whom he was most popular, and his loss will be keenly felt by all connected with the telephone industry.

CITY NOTES.

Electric and General Investment Co., Ltd.

The report of this company for the year ended May 31st last, states that the gross profit is £38,621. Of the balance of £26,274 the directors have carried to the contingencies fund £20,274, leaving £6,000. The amount standing to the credit of the contingencies fund has consequently been raised to £66,988. The directors recommend a balance dividend of 3s. 6d. per share, making a total distribution of 4s. 6d. per share, or 22½ per cent. for the year on the ordinary shares, and a dividend of £25 per founders' share. The trustees for the ordinary shares reserve fund propose to distribute 1s. per share out of the dividends received on the trust investments, making, with the dividend from the company, a total present distribution of 4s. 6d. per share, or, with the interim dividend already paid, 5s. 6d. on each ordinary share. The trustees for the founders' shares reserve fund propose to distribute £10 per share out of the dividends received on the trust investments, making, with the dividend from the company, a total present distribution of £35 on each founders' share. The directors consider the present an opportune time for reconstructing the company, in order that the founders' shares may be extinguished and that additional capital may be raised to cope with the increasing and profitable business. It is probable also that the company, when reconstructed, may be able to acquire, on terms which should prove advantageous, a large amount of the electrical securities held by the late Mr. George Herring. It is proposed to enlarge the board of the new company. The new company is to be registered as the Electric and General Investment Co. (1907), Ltd., with an authorised share capital of £500,000 in 200,000 6 per cent. cumulative preference shares of £1 each, with priority in return of capital, and 300,000 ordinary shares of £1 each. The whole of the goodwill and assets of the existing company, including the reserve funds held by the trustees of the ordinary and founders' shares reserve funds, are to be transferred to the new company in consideration of the sum of £200,000, payable as to £99,500 in preference shares credited as fully paid up, and as to £100,500 in ordinary shares credited with 10s. paid up.

Lisbon Electric Tramways.

The ninth ordinary general meeting of this company was held on Wednesday at 1, London Wall Buildings, Sir Charles Euan Smith presiding.

In moving the adoption of the report (see Electrical Review, June 14th, page 976), the Chairman said they were pleased to be able to report the continued progress of the company. The business had still further developed, causing a demand to be made for increased rolling stock, and notwithstanding the additions made in the previous year, they had again made a considerable increase in the number of cars. In order to get electrical power they had completed the erection of a turbine power station. The result of the company's operations, after deducting interest and amortisation due on the debentures of the "Companhia Carrio de Ferro de Lisbon," and after the payment of £25,000 for interest on the debentures of the company, and the payment of administrative expenses, was a net profit of £96,117, which, added to the balance of £16,096 brought forward from the previous year, showed a total of £112,213. Out of that sum they had placed £35,000 to depreciation, making that item £110,000, and added £5,000 to the exchange reserve account, raising that item to £15,000, leaving an available sum of £72,213. They had paid £25,533 for the usual preference dividend, and they now recommended the payment of a 5 per cent. dividend on the ordinary share capital, which would absorb £29,709, and left a balance of £16,971 to be carried forward. During the year 100,000 ordinary shares of £1 each had been offered to the shareholders, and 94,188 of them were subscribed for, and the premiums on the shares, £19,022, had been placed to the reserve fund. The Santa Justa Elevador, which the company owned, had been leased for the remainder of the concession at a rental of £1,500 a year, with the option of buying it back within a certain number of years for £25,000. When the elevator was built it was not constructed with the idea of making a profit, but to increase the travelling facilities of the public, and it also formed a connecting link between the lower and upper town. The old-fashioned cage and equipment would be replaced very shortly by a more up-to-date type of machinery, thus increasing its usefulness. The board recommended the payment of 5 per cent. dividend after having placed the same amount to the different items as last year, including £35,000 to depreciation, which they thought was amply sufficient for the present requirements of the company. He was pleased to say that the relations existing between the company, the Portuguese Government, and the municipal authorities of Lisbon continued to be of a most friendly character, and their tramways had maintained their popularity, as they deserved to do, considering the high efficiency of the service.

Mr. Ludwig Breitmeyer seconded the motion, and the report was adopted.

The Globe Telegraph and Trust Co., Ltd.

The directors' report on the balance-sheet and accounts for the thirteen months ended May 31st, 1907, states that, owing to the fact that some of the companies in which large investments are held, have altered the date of the closing of their accounts, thus deferring the payment of their dividends to a somewhat later date than hitherto, it has been deemed advisable, in the interests of shareholders, to alter the date of this company's financial year, making it to close as on May 31st, instead of, as hitherto, April 30th—thus enabling the directors to include among receipts for the current period, those dividends which formerly were received within the year ending April 30th. The net revenue of the company for the thirteen months ended May 31st, after deduction of expenses, amounts to £244,097, and makes, with the balance of £4,500 brought forward, a total of £248,597. From this amount there has been distributed the sum of £131,769 in interim dividends, leaving an available balance of £116,827. The directors now recommend the payment of the following final dividends, which on this occasion cover a period of four months to May 31st—viz., 4s. per share, less income-tax, on the preference shares, making 6 per cent. per annum, less income-tax, for the period of thirteen months; and 6s. 2d. per share net on the ordinary shares, making 5⅔ per cent. net for the year which formerly ended April 30th, plus 8d. per share in respect of the month of May, representing one-third of the interim dividend of 2s. usually paid in the first quarter of the new financial year. These dividends will absorb the sum of £90,262, and leave a balance of £26,566 to be carried forward to the next account. In conformity with the articles of association, one of the directors—viz., the Most Hon. the Marquis of Tweeddale, K.T., retires, and, being eligible, offers himself for re-election.

The British Electric Traction Co., Ltd.

The report for the year ended March 31st, 1907, states that the net profit, after reserving £25,000 against depreciation of undertakings worked by the company, buildings and freehold land, doubtful debts and expenditure on undertakings not proceeded with, is £207,462. This includes £17,136 brought forward from last year and also £41,968 being one half of the remaining profits on the Bombay undertaking. The directors propose to apply the above-mentioned sum of £207,462 as follows, viz.:—

Interest on 5 per cent. perpetual debenture stock for the year ended March 31st, 1907	£73,683
Interest on 4½ per cent. second debenture stock for the year ended March 31st, 1907	23,802
Dividend at the rate of 6 per cent. per annum on the preference shares for the year ended March 31st, 1907 (paid to February 15th, 1907)	96,862
Carried forward to next account	13,115

The subscribed share and debenture capital remains the same as at March 31st, 1906, viz.:—£1,333,010 in ordinary shares of £10 each; £1,614,370 in 6 per cent. cumulative preference shares of £10 each; £1,473,653 in 5 per cent. perpetual debenture stock; and £528,936 in 4½ per cent. second debenture stock; a total of £4,949,969.

Investments in associated and other companies have an aggregate par value of £5,271,977, and they stand in the books at a cost of £4,967,999 (*i.e.*, £303,978 below par). The yield for the past year has been £152,925, equal to 4⅔ per cent. on £3,275,364, the cost of the investments which are revenue earning. The yield shows an increase of £9,273 upon the preceding year, notwithstanding that the Brush Co., which gave a return of £13,711 for 1905, has paid no

dividend for the past year. During the past year investments of the cost value of £135,720, upon which no return was earned in 1905-6, have become remunerative. On the other hand, the list of unremunerative investments has been increased by shares of the cost value of £405,052. Of the latter amount, the Brush Co. represents £219,957, and the balance includes South Metropolitan, £136,297, and Jarrow, £32,110, the lines of these companies having only recently been completed. Apart from these, the investments added to the unremunerative list represent a cost of only £16,688. The total gross profits of the associated companies, after debiting expenses but before charging interest on capital or loans or rental of leased lines, were, 1905, £464,204; 1906, £539,455. There are a few companies other than the Brush Co. which show diminished profits (£1,097) for the past year; a few which show actual losses (£3,275); and some—Automobile Co., Bombay, Cavehill, Jarrow, Leamington and Warwick, South Metropolitan, and South Shields—which are not comparable, not having been in operation during both years. The directors are considering means for resisting the constant demand for reduction of fares, and for obtaining an augmentation in cases where the service is unremunerative and the local circumstances permit.

The report of the Auckland Co. shows increases both in the number of passengers carried and in the average receipts per passenger, while the expenditure per passenger has fallen. To meet increasing traffics further cars and plant are to be ordered, and the board have decided to take in hand the construction of some extensions. The capital required for carrying out these works has been raised in New Zealand.

The report of the Birmingham and Midland Co. shows that notwithstanding that several important lines reverted to the Corporation of Birmingham on June 30th, 1906, the company has been able to earn an increased profit.

The report of the Bombay Co. for the past year has not yet been issued, but the directors are informed that some of the lines were opened for working by electric traction during the past month with satisfactory results. The business of electricity supply at Bombay is also developing satisfactorily, and altogether the prospects of the Bombay Co. are very promising.

The report of the Brush Co. for the past year shows that the profits available for distribution were £41,934 as against £52,863 for the preceding year.

The report of the Metropolitan Electric Tramways shows the continued progress of this large and important undertaking, which, at December 31st, 1906, was working over 29 miles of tramways in North London, and owns all the issued shares of the North Metropolitan Electric Power Supply Co., which company is supplying electricity in bulk in a large and important area. The business of power supply is developing satisfactorily.

The lines of the South Metropolitan Co. were opened for traffic during the past year, and the directors anticipate satisfactory results from the working during the current year.

The reports of the other companies do not call for special comment; their accounts have, as in previous years, been separately audited and published.

Details of the management and general expenses again show reductions upon the preceding year. The total is £48,689, as compared with £54,467 in 1905 6, £61,436 in 1904-5, and £82,095 in 1903-4.

The directors regret that they are not able to recommend the payment of a dividend on the ordinary shares for the past year.

Owing to the stringency of the money market, and to the discouragement of electrical enterprise in this country, the profits earned during the past year from sources other than investments have been small. The inadequacy of the profits on the working of tramways is due mainly to the action during the past few years of municipal authorities, which has caused an increase of capital expenditure, while reducing the revenues and otherwise prejudicially affecting the enterprise and profits of companies.

In the manufacturing departments, exposed as this industry is to the free importation of manufactures from abroad, a large increase of work has been accompanied by further reduction in prices, as is evidenced by the report of the Brush Co., so that less net profit has been earned.

The Right Hon. H. O. Arnold-Foster, M.P., and Mr. P. D. Tuckett will join the board of directors; Mr. J. S. Raworth retires, but offers himself for re-election.

Elmore's German and Austro-Hungarian Metal Co.

MR. J. MACFARLANE presided on Thursday last week at Finsbury House, E.C., over the annual meeting of the above company, and in moving the report (see ELECTRICAL REVIEW, of June 7th, 1907), said that the directors confessed that the net results of the working of the Metall Co. during the year 1906, had not reached their expectations, but the conditions which existed during the whole year were against big profits. Every item which influenced the cost of manufacture (such as wages, coal, copper and stores), over which the directors had no control, showed a great advance, and such increases had resulted in a diminution of profits by over £5,000. Those items over which the directors had control, showed an actual decrease, and they were not relaxing their efforts to effect still further economies. With regard to the volume of work done by the Metall Co., the directors had no cause for dissatisfaction, as year by year the demand for the manufactures of the company continued to increase, and although a set back might be anticipated in the prosperity of German trade, the directors were satisfied that the Metall Co. would always have a sufficiency of orders. The actual amount sold last year was little more than in 1905, as owing to the state of the copper market they had some difficulty in obtaining supplies of just the class of copper they required for their piercing process, and delays often occurred. But to have increased their profits at all under such adverse conditions, was good ground for believing that when normal conditions obtain, the company would be placed once more on a dividend-earning basis. All they desired was to work under conditions which were stable, and not to be subject to violent fluctuations such as existed during the year 1906. With regard to the prospects for the present year, there was every reason to believe that even though the present stringent conditions continued, the net profit would show a substantial increase. Additional plant had been installed, which would both accelerate and cheapen production. The easier financial position of the company would enable the directors to increase the sales, while the arrangement with the bankers in Germany would result in a sensible reduction in their interest account. With regard to the Austrian company, he had very little to say, as, of course, the position and prosperity of that company depended entirely upon the results obtained by the Metall Co. But he could not refrain from expressing his regret that the debenture-holders did not fall in with their proposal and exchange the 8 per cent. debenture stock for a new issue of 5½ per cent. The effect that such exchange would have had upon the standing of the company would have been considerable, for in that case it would have been their pleasing duty that day to have declared a dividend upon the preference shares. However, the debenture stock holders had consented to the repayment of their stock being deferred until July 1st, 1912, an extension of five years, and during that period they must do their best to place the company in the position of being able to pay out those holders who declined to exchange. The gross profit of 537,922 marks, or £26,896, made by the Metall Co. was the largest yet made, and had the capital employed been share capital only, the net profit would have been £10,175 more, as that was the amount that was paid during the year for interest and commission on loans. During the present year important progress had been made, and the sales largely increased—the increase to date having amounted to over 25 per cent. more than for the same period last year, so that without being too optimistic, it was reasonable to anticipate a better result of the year's work than had yet been attained. The directors had visited the factory at Schladern, and were pleased to report that they found the works in excellent order, and that much had been done, and was being done, in the way of labour-saving devices which were not only increasing the capacity of the factory, but were effecting considerable reductions in the cost of manufacture.

Mr. J. HEAL seconded the motion, and the report was adopted after the chairman had answered a few questions dealing with the accounts.

Hong Kong Electric Co., Ltd.

THIS company held its annual meeting at Hong Kong on May 8th, Mr. A. C. Wood presiding.

The CHAIRMAN said that the accounts showed a continual expansion in the company's operations the services now equalling upwards of 44,500 lamps of 8 C.P., 85 arc lamps, and 120 lifts, against 39,500 lamps, 85 arc lamps, and 80 lifts at the date of the last report. Further connections, both of lamps and lifts, are now in hand. The plant account showed a considerable increase, mainly due to payments on account of the new system of underground distribution laid throughout the centre of the city. This work was commenced during last summer, and had replaced the old system of overhead distribution throughout the central area with very satisfactory results, both as regards freedom from interruption by storms and typhoons, and also efficiency and economy in service. The balance of profit and loss amounted to $110,449.72, as compared with $103,244·69 for the previous ten months' working, a result which would have been more favourable had not the price of fuel risen so much above the rates at which they were able to arrange contracts in the previous year. The cost of Japanese coal had now receded to figures nearly comparable with those ruling in 1905. $107,449 72 remained available for appropriation, and the directors proposed to pay a dividend of 10 per cent., say $1 per share on 59,991 fully paid up shares and 50 cents per share on nine part-paid shares; to write off the sum of $44,120.80 from plant account, and $379.76 from furniture account for depreciation, and to carry forward $2,953.66. This would maintain the dividend at the rate of $1 per share on practically the whole of the shares issued, and thus represent a dividend disbursement of $10,500 in excess of that made at the last general meeting. The appropriation for writing down the plant was a substantial one, and followed out the policy which the board had consistently adopted for a number of years past. It was a necessary provision, in view of the frequent changes and improvements that had been and were being introduced in electric plant. In view of the increased cost of coal and the disabilities under which the generation of steam power was carried on at the present Wanchai works, they had had under serious consider- the adoption of other and improved methods of generating power. After careful inquiries, they decided, in July last, to order two sets of Diesel oil engines, combined with alternating current dynamos. These sets were of 300 H.P. each, and were expected to be be delivered and erected so as to be ready for use in the autumn. The work of reconstructing a portion of the station to house these new sets was well in hand. He believed that the adoption of this new plant would result in a substantial saving in the fuel account, and reduce the expense of generating electricity to such an extent that they would be able to lower the present scale of charges to the consumer.

The report was adopted.

The Paris Metropolitan Railway.

The report for 1906 of the Compagnie du Chemin de Fer Métropolitain de Paris, which was approved at the ordinary general meeting held on May 18th, first refers at some length to the tunnelling works executed by the City of Paris during the year, and to the works put in hand by the Company and those now in progress or preparation. Various new sections of line were opened during the year, which commenced with a mileage of 19·7 miles and ended with 27·4 miles, the average length worked for the whole year being 23·56 miles. At the end of 1906 the rolling stock was composed of 327 motor coaches and 379 trailers, being a total of 706 vehicles, whilst 190 motor coaches and trailers were in course of construction, and orders for 64 others have been given since the beginning of 1907. The report, in dealing with the problem of ventilating the underground sections, states that direct ventilation has been tried by means of wide openings made in the road on the Boulevard de Belleville and at the Station de Rome. On the other hand, artificial ventilation is in course of observation near the Station de Ternes. The solution of arranging a portion of the station open to the air deserves the favourable reception which it has had from the public and the company's *personnel*, without giving rise to the inconveniences of noise, draughts and clouds of dust which appear difficult to avoid with the use of fans. If this arrangement could be made at all the stations, the problem of ventilation could be deemed to be solved. An investigation has been made showing that openings can be made at a certain number of the existing stations without causing any inconvenience to the surface traffic, and a scheme for this purpose has been submitted to the responsible authorities for approval. An arrangement has been made with the city authorities in regard to the establishment of lifts, and consideration is also being given to the question of travelling stairways. The accounts show the following figures for the year 1906 :—

Ordinary share capital	75,000,000	fr.
Bonds	23,500,000	,,
Gross receipts	29,396,707	,,
Working expenses	12,562,773	,,
Municipal share of receipts	9,400,011	,,
Net profits for the year	6,849,949	,,
Dividend on ordinary shares ...	19	,,
No. of tickets issued	165,319,216	,,

The dividend is at the same rate as the company paid for 1905, and the number of passengers carried (tickets issued) compares with 148,700,000 in 1905. The proportion of working expenses to gross receipts was 42·73 per cent. in 1906, as contrasted with 43·34 per cent. in 1905, 42·49 per cent. in 1904, 42·90 per cent. in 1903, 41·52 per cent. in 1902, and 47·15 per cent. in 1901. In addition to allowing of the payment of the dividend on the share capital the net profits have permitted of the placing of 5 per cent. to the statutory reserve fund and the redemption of 1,990 ordinary shares which have been drawn for repayment. The drawings of shares will, in accordance with the statutes, take place annually, the final drawing being in 40 years from the present time. The number of employés increased from 2,730 at the end of December, 1905, to 3,404 on December 31st, 1906; the company has extended the system of awards, which interests the different classes of servants in the efficient working of the railway, and no less than 295,671 fr. has been distributed among them in the past year, or 66,000 fr. in excess of the sum devoted to the same purpose in 1905.

India-Rubber, Gutta-Percha and Telegraph Works, Ltd.

Major Darwin presided at the Cannon Street Hotel on Tuesday over the half-yearly general meeting of the above company.

In moving the adoption of the report, the Chairman said the board was pleased to inform the shareholders that since the beginning of the financial year there had been a marked increase in some lines of their manufactures, and although others did not show an increase, and some even a falling-off, yet the balancing of advances and shortages produced a substantial increase in the sales. While reporting this favourable feature, the board was unable to state that the profit might also be accepted as proportional to this increase in sales. They had, however, an indication of the board's opinion by being asked to sanction the usual interim payment. The price of raw material was lower, and it was probable that this lowering would be progressive, although they would doubtless have occasional set-backs. The period during the lowering of the price of raw materials was always an anxious time for the managers of an industrial concern when the price had remained high for a considerable time, and this was due to the fact that where a stock of production was kept, this stock had naturally been manufactured with high-priced materials, and could only be profitably sold if the scale of selling prices remained sufficiently long at the proper figures. The board, however, had had experience on different occasions of this state of things, and were prepared to deal with the situation. Since he last addressed them they had secured an order for the manufacture of a submarine cable and the laying of it between New York and Havana. One-half of the length required was already manufactured, and although they had been delayed through short deliveries of some of the material they had had to purchase, yet they were turning it out at from 20 to 25 nautical miles per day. At these meetings he referred to the excessively high rates which they had to pay in the district where their works were situated, and he did so with intention, as, unless public attention was drawn to these matters, the burden would go on increasing, with the most serious effect on industrial undertakings. He was sorry that the recently formed Metropolitan Water Board found that the water rate collected from them and other manufacturers was insufficient for its purposes, though it amply sufficed during the *régime* of its predecessor in their district, the East London Water Co. The Board was asking for exorbitant Parliamentary powers, and they and other manufacturers had been obliged to approach Parliament in opposition to the Bill. He was afraid that, in spite of everything they had been able to lay before a Joint Committee of both Houses of Parliament, they would have this further burden thrust upon their already overtaxed section of the community. As they were now making motor tires with improved machinery, he hoped that the shareholders who were motorists, or who had friends that were, would make known the excellence of the Palmer cord and the Persan tires. Mr. Henry Marsham was again seated with them, and joined in their councils. He arrived in the spring from Japan. They were pleased to say that their manufactures enjoyed the best of reputations in Tokio and the other larger cities of that country, and they hoped that they would always enjoy the confidence reposed in them. Before closing his remarks, he would like to refer to another matter of general interest to public companies. In reply to a communication from the Institute of Directors, the board decided that they would sign a petition in favour of the extension of the municipal franchise to joint-stock companies. Whilst heartily supporting this policy, he might express a hope that the Institute would regard this question from all points of view. A single vote to each company would give its representative the right of speaking as a voter as public meetings, and presumably, if elected, to serve on the local body in question. It would, however, have the false appearance of removing a grievance, and it would thus somewhat weaken their position. In his opinion, the only effective additional safeguard was to be found in giving the public better means of ascertaining the facts. If the local auditors were made absolutely independent of the local authorities; if they were to report direct to the Local Government Board; and if these reports were to be published immediately in the district, more would be done towards safeguarding the interest of joint stock companies than could be effected by any system of franchise reform. He moved that the distribution of an interim dividend of 2½ per cent. or 5s. per share payable free of income-tax be approved.

Mr. Moore seconded the motion, and the report was adopted.

Pelmadulla Rubber Co., Ltd.—The report of the directors for the year ended December 31st last states that the rubber planting at Pelmadulla during the year proceeded in a satisfactory manner, and an addition was made of 709 acres, representing 141,800 trees, bringing up the total to 1,185 acres with 241,760 trees. The average cost per planted acre was about £8 per acre. The programme for 1907 is to plant out 515 acres, so as to bring up the rubber area to a total of 1,700 acres.

Telephone Co. of Egypt, Ltd.—The register of transfers of 4½ per cent. Debenture Stock will be closed from June 15th to 29th, inclusive, for the preparation of warrants for interest due July 1st.

Electric Tramways of Montevideo, Ltd.—This company held its meeting on Friday last. The report for the year ended March 31st last, stated that the traffic receipts totalled $364,892, an increase of $14,939, but the expenses were $27,730 higher, so that the net receipts were reduced by $12,791 to $80,828. The decrease in the net receipts was due to the interference with the track caused by the work of electrification, and also to a large increase in the cost of fodder. When the electrification of the systems is completed these difficulties will disappear, and large increases in the receipts are anticipated. The directors recommend the payment of a dividend on the ordinary shares of 2 per cent., requiring £4,750, and leaving to be carried forward £690.

Sheerness and District Electric Power and Traction Co., Ltd.—The eighth ordinary general meeting of the shareholders of this company was held on Thursday last week, Mr. W. L. Madgen presiding. The chairman formally proposed the adoption of the report (see Electrical Review, June 14th) which was seconded by Mr. Geo. Offor and carried.

R. Waygood & Co.—The seventh ordinary general meeting was held on the 17th, Mr. Henry C. Walker presiding. The company manufactured over 1,000 lifts during the past year; they had also some fine specimens of electric cranes working, and it was hoped to develop this class of work. The profit of the past year amounted to £24,068. After deducting directors' fees, reserve, dividend on the preference shares, and interim dividend on the ordinary shares, there remained a balance of £7,793. It was proposed to pay a further dividend at the rate of 7 per cent. per annum for the six months ended March 31st last, making 6 per cent. for the whole year on the ordinary shares, and leaving £3,068 to be carried forward. After discussion, the motion was agreed to.

Light Railway Commission.—The offices of this Commission were yesterday (20th inst) transferred from 54, Parliament Street, S.W., to Scotland House, New Scotland Yard, S.W.

Oriental Telephone & Electric Co., Ltd.—The register of transfers of 4 per cent. debenture stock will be closed from June 15th to 29th inclusive, for the preparation of warrants for interest due July 1st.

British Westinghouse Electric and Manufacturing Co., Ltd.—The transfer books of the 4 per cent. mortgage debenture stock will be closed from June 17th to 30th inclusive, for the preparation of warrants for interest payable July 1st.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	June 12	2,424	— 322	2	2,424	— 322	14·4	..
Ayr	,, 15	569	— 116	5	1,279	— 119	8	..
Bath	,, 12	1,490	— 596	24	17,510	— 54	13	..
Belfast	,, 14	7,350	— 88	11	39,288	+ 2,087	40	..
Birkenhead	,, 16	2,087	— 179	11	11,250	— 510	13·52	..
Birmingham Corp.	,, 1	12,730	..	9	58,088	..	56·15	..
Blackburn	,, 12	2,044	— 541	11	12,720	+ 695	14·12	..
Blackpool Corp. ..	,, 13	1,494	—2,943	..	9,193	— 1,404	11·87	..
,, —Fleetw'd.	,, 15	935	—1,867	23	9,038	— 124	8·25	..
Bolton	,, 16	4,488	— 645	11	24,752	+ 696	26	..
Bournemouth ..	,, 12	3,063	— 901	10½	17,480	— 40	21·5	2·75
Bradford	,, 15	9,388	—2,069	11	50,207	— 160	53	..
Brighton	,, 16	1,694	— 661	11	9,680	..	9·5	..
Bristol	,, 14	10,056	—2,668	..	..	..	28·5	..
Brit. Elec. Trac. Co.								
Airdrie	,, 7	455	— 11	22	4,944	+ 7	3·65	..
Barnsley	,, 7	200	— 86	,,	3,579	— 82	..	..
Barrow	,, 7	518	— 166	,,	5,119	— 56	5·37	..
Cavehill	,, 7	156	— 62	,,	1,629	+ 15	..	..
Devonport	,, 7	900	— 137	,,	9,848	+ 66	8·85	..
Gateshead.. ..	,, 7	1,879	— 168	,,	21,904	+ 723	11·25	..
Gravesend	,, 7	455	— 169	,,	5,066	+ 61	6·5	..
Greenock	,, 7	1,413	— 90	,,	14,128	+ 88	7·25	..
Hartlepool	,, 7	527	— 235	,,	5,789	— 386	6·72	..
Kidderminster ..	,, 7	219	..	,,	2,291	— 129	..	..
Leamington	,, 7	322	— 199	,,	3,357	— 214	3	..
Merthyr	,, 7	393	— 92	,,	4,568	+ 231	2·9	..
‡Metropolitan ..	,, 7	8,937	+ 8	,,	93,287	+20,775	22	..
Middleton.. ..	,, 7	855	— 70	,,	7,493	+ 178	8·5	..
Mid. Joint Com'tee	,, 7	11,628	—1,796	,,	125,386	+ 1,260	..	..
Oldham — Ashton	,, 7	1,927	— 37	,,	13,159	+ 800	9·18	..
Peterborough ..	,, 7	210	— 129	,,	2,520	— 40	5·81	..
Potteries	,, 7	3,816	— 189	,,	41,257	+ 785	29	..
Rothesay	,, 7	322	— 112	,,	2,228	— 85	2·75	..
Southport	,, 7	677	— 276	,,	5,789	— 277	8·17	..
S. Metropolitan ..	,, 7	1,577	+ 147	,,	16,101	..	..	..
Swansea	,, 7	1,690	— 814	,,	18,293	+ 455	5·5	..
Tynemouth	,, 7	390	— 379	,,	4,001	— 601	3·75	..
Weston-s-Mare ..	,, 5	232	— 201	,,	1,456	— 30	3	..
‡Worcester.. ..	,, 7	542	— 193	,,	5,711	— 141	5·75	..
Wrexham	,, 7	191	— 47	,,	2,167	— 34	..	..
Yorks. Wool. Dist.	,, 7	1,773	— 390	,,	20,789	+ 67	17	..
Miscellaneous ..	,, 7	412	— 60	,,	4,615	— 107	..	..
Burnley	,, 15	2,434	— 358	..	..	..	7·5	..
Burton-on-Trent ..	,, 16	584	— 96	11	3,119	— 229	10	1·5
Bury	,, 9	2,359	..	10	10,662	..	10·5	..
Cardiff	,, 15	4,143	— 876	11	22,581	— 4	15·87	..
Carlisle	,, 15	359	— 84	24	3,791	— 326	..	..
Chatham and Dist.	,, 13	1,503	— 103	24	15,884	+ 1,169	12·84	2·55
Cork	,, 13	971	— 208	24	10,267	— 348	9·89	..
Croydon	,, 14	2,866	— 775	11	15,406	— 1,118	12	·75
Darlington	,, 15	423	— 27	11	2,312	+ 3	..	..
Darwen	,, 14	518	— 41	11	3,777	— 41	4·96	..
Dover	,, 15	434	— 152	11	2,400	— 250	4·75	..
Dublin	,, 14	11,480	— 157	22	120,645	+ 7,142	54·25	5·5
Dundee	,, 12	2,236	— 24	4	4,470	+ 129	13	·5
East Ham	,, 15	1,788	— 419	11	9,964	— 333	8	..
Exeter	,, 7	802	— 118	10	3,048	+ 276	4·75	·5
Glasgow	,, 15	35,323	—1,750	2	38,949	— 4,727	89·75	9·5
Hastings	,, 13	1,947	..	..	..	..	..	..
Huddersfield	,, 15	3,173	— 548	11	17,596	+ 571	28	..
Hull	,, 15	4,849	+ 10	11	25,989	+ 1,460	13	..
†Ilford	May 11	560	+ 37	6	2,884	— 117	6·37	..
Ilkeston	June 12	275	— 58	11	1,550	+ 139	3·5	..
Ipswich	,, 15	794	— 310	11	4,236	— 351	10·5	..
Isle of Thanet ..	,, 15	1,137	— 139	24	8,504	+ 36	11	..
Kilmarnock	,, 15	323	+ 1	4	745	+ 25	4·25	..
Lan'kshire Trm. Co.	,, 13	2,416	+ 454	24	25,362	+ 5,511	15·82	3·26
Lancashire United	,, 12	2,462	— 63	24	28 186	+ 7,670	38·5	10·5
Leeds	,, 15	13,199	—1,813	11	70.936	+ 2,693	96	6·5
Leicester	,, 15	4,639	— 854	..	..	..	..	..
Leith	,, 15	1,062	— 31	4?	2,377	— 75	6	..
Liverpool	,, 8	22,052	—1,317	23	242,593	+ 3,228	104	..
‡L.C.C.	,, 8	61,334	+5,664	9	304,670	+41.789	116·6	19·25
London United ..	,, 14	13,558	—4,492	22	139,957	+ 2,907	..	..
Lowestoft	,, 15	365	+ 4	37	5,791	+ 789	3·5	..
Manchester	,, 15	29,244	—2,659	11	159,294	+12,749	172	21
Newcastle	,, 15	8.127	+ 6	..	44,389	+ 1,052	..	..
Newport	,, 15	2,350	+ 854	11	8,348	+ 1,416	14·5	..
Northampton ..	,, 14	847	— 305	10½	4,678	— 166	6·5	..
Oldham	,, 16	3,698	— 212	12	23,040	+ 1,654	28·75	..
Pontypridd	,, 15	469	+ 43	11	2,944	+ 992	5	1·75
Portsmouth	,, 15	3,786	—1,439	11	20,723	— 768	14·5	..
Preston	,, 12	1,436	— 474	..	..	..	..	..
Reading	,, 13	1,206	— 295	10½	6,492	— 181	13·25	..
Rotherham	,, 13	1,170	— 106	10½	6,274	+ 870	10	·66
Salford	,, 17	9,594	—1,363	11	52,188	+ 1,078	38·9	..
Sheffield	,, 16	11,179	— 227	12	65,773	+ 2,757	35·75	..
Southampton	,, 12	1,187	— 86	10	10,319	+ 815	..	..
Southend-on-Sea ..	,, 12	712	— 268	11	3,656	— 197	..	..
Sunderland	,, 16	2,829	— 324	11	15,078	— 147	..	..
Swindon	,, 12	322	— 5	..	..	..	4·4	..
Tyneside	,, 12	883	— 281	24	9,806	— 696	8·87	..
Wallasey	,, 15	1,652	— 356	11	8,918	+ 148	8·5	·05
Walthamstow	,, 15	1,214	— 20	11	6,477	— 249	9	..
West Ham	,, 13	4,547	— 602	..	26,068	+ 949	14·7	..
Wolverhampton ..	,, 13	1,648	— 614	10	9,202	+ 145	20	..
Yorks. W. Riding ..	,, 16	2,300	+ 42	24	26.579	..	..	..
Baker St.-Waterloo	,, 15	4,950	+2,007	14	33,270	+12,934	4	·75
Cen. London Rly.	,, 15	11,607	—1,046	24	146,152	—15,224	6	..
City & S. Lon. Rly.	,, 16	6,171	+1,128	24	71,235	+ 8,583	7·3	1·05
Dublin-Lucan Rly.	,, 14	246	— 78	24	2,485	— 12	7	..
G.N. and City Rly.	,, 15	3,526	+ 181	24	43,542	+ 223	3·5	..
G.N., P'dy. & Brmp.	,, 15	8,810	+ 300	24	94,029	..	9	..
L'pool Over'd Rly.	,, 16	2,947	— 272	24	34,413	+ 461	6·8	4·3
Mersey Railway ..	,, 15	3.807	+ 169	24	44,223	+ 2,365	4·5	..
Metropolitan Rly.	,, 16	81,698	—1,405	24	364,821	—26,908	24·5	..
Met. District Rly.	,, 16	16,692	— 11	24	189,489	— 8,898	24	..
Anglo-Argentine ..	,, 17	32,722	+3,990	24	396,529	+37,260	48	..
§Auckland	May	10.246	+ 457	20	53,380	+ 3	19·2	·56
§Brisbane	,,	13,275	+1,584	..	..	..	..	..
§Brit. Columbia Rly.	Apr.	24,067	+6,522	37	245,426	+48,466	..	..
Bu'n's A'r's E.T.Co.	Mar. 2	3,247	+ 290	9	14,647	+ 1,859	..	..
†Bu'n's A'r's-Blgr'no	Apr. 21	3,911	+ 314	16	60,228	+ 4,091	..	..
Calcutta	June 15	6,184	+ 415	..	..	..	..	..
§Cape Electric T. Ld.	May	12,710	..	..	..	..	..	..
§Geneva	,,	3,309	+ 422	..	..	..	..	..
§Kalgoorlie, W.A...	,,	3,937	..	21	19,545	..	20½	..
Madras	June 15	1,049	+ 123	23½	12,554	+ 2,044	12·75	2·25
§Lisbon	Apr.	25 661	..	..	..	..	..	..
Perth (W.A.) ..	June 14	2,680	— 205	24	34,909	— 1,046	25·6	·4

* Compared with the corresponding period of 1906. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Evening.

END of June money requirements are casting their shadow before, in the sense that investment demand is somewhat stayed, pending the turn of the half-year. It is understood that the greater banks will probably dispense with the practice of "window-dressing" that has hitherto prevailed at this season, and this, together with the abundance of floating capital, will prevent any noticeable tightness in the money market; so that the influence of the half-year's conclusion will be negative rather than positive.

Electricity issues continue very quiet. The only feature has been the little excitement produced by the proposals to raise the fares upon the Underground lines; the bare suggestion was hailed with sharp rises in Metropolitan, District and Central London stocks. After the advance in the railway fares, speculative inquiry asks whether the next thing will be a rearrangement of the rates on some of the tramway systems—the London United, for instance. The tramways have not found their lines laid in places any too pleasant for the shareholders.

Rises in the list of electricity supply shares are not so common that the advance in Metropolitans to 6½ can be left, say, to the last paragraph for mention. The other London shares show a duller tendency. Brompton Ordinary, for some time past a very steady market, lost ¼ at 8¼. City Ordinary follow up their fall of ⅜ last week with a decline of the same fraction as Bromptons. London Electric Preference are ⅛ down, and Edmundson's Ordinary have dropped into a more or less nominal quotation, at 15s. middle. Debenture stocks are unchanged, except for one or two *ex* interest markings.

In a weekly financial paper we learn that the market in electric lighting shares is practically in the hands of one man. We should think the statement would cause much heart-burning amongst the various jobbers who deal in electric lighting shares. Certainly it is true that the market is extremely circumscribed, for the simple reason that the public demand and supply are too small to make much competition worth while. The wideness of the prices quoted in this department has been a frequent theme of criticism here, but of late years the dealings have grown more and more retail, until it has simply come to this: that a number of the prices are almost nominal, for lack of business in the shares, of which the wideness of the quoted values affords a clear indication. It undoubtedly has the effect—which those responsible for the prices may not altogether desire—of impressing upon the public mind the unmarketability of the shares, and therefore of keeping investors away from this market.

Metropolitan Railway Consolidated shot up to 43½ upon the news that the fares were to be raised. Districts rose to 13, after being 10; and Central London Ordinary added 3 points, making the price 74. The latter has maintained its rise, but the two others receded a little after their spurt. Metropolitans declined to 42½ and Districts to 12, though both these prices show substantial gains on the week. City and South London rose 3 to 45, due to the steadily increasing nature of the traffic receipts, and the fact that on the basis of the last dividends the stock pays 4½ per cent. on the money, with the prospect of an increased distribution being declared next month. But Great Northern and City Preferred shares are down to 2¼, equivalent to 22½ if the price were converted into the basis of £100 stock. It is a curious coincidence, possessed of significance, that while the Tube stocks have been harder, Underground Electric Profit-sharing Notes are down 3, to 68½.

British Electric Traction Ordinary dropped back to 27s. 8d. and the Preference to 7, after both had been better prior to the issue of the report. That document we heard described as a poem, but it is doubtful whether the proprietors will appreciate the effort. The dividend on the Preference shares is paid, although a cautious policy might have dictated the usiug of this money, or part of it, in writing off more than a paltry £25,000 from investments standing in the balance-sheet at over three millions sterling. The amount available for distribution is swollen by the profits arising out of the Bombay business, but this was more or less of a windfall, not regular income at all, and should have been utilised in one of the reserve or depreciation funds, or to stiffen the carry-forward.

Other traction issues call for little comment. Cape Electric Trams are 1/16 lower, in consequence of the unhappy developments in South Africa in connection with the mining industry.

Electric Constructions are weak, and Henleys have receded ¼ in each class of share. Willans and Robinsons have begun to crumble again. Three of the British Aluminium prices have been marked *ex* dividend, and Callender's at 10 are *ex* the 10s. distribution.

Telegraph stocks are exceedingly idle. Eastern Ordinary fell a point, and Eastern Extension shares went ¼ lower. Globe Telegraph Ordinary followed a similar course. The telephone list is quite unaltered.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1903.	1904.	1905.	1906.	Closing Quotations June 11th.	Closing Quotation June 18th.	Business done week ended June 18th, 1907. Highest.	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	3 — 3½	3 — 3½	..	..	..	Nil
149,600	Do. do. 5 % Debs., Nos. 1 to 1,350 Red.	100	Nil	Nil	5 %	5 %	88 — 91	88 — 91	..	..	..	5 9 11
660,660	Anglo-American Telegraph	Stock	61s.	2½%	3½%	5½%	6½ — 6¾	6½ — 6¾	..	..	..	6 0 2
3,169,670	Do. do. do. 5 % Pref.	Stock	6 %	5½%	6 %	6 %	107½—108½	107½—108½	108½	107½	..	5 10 10
3,169,670	Do. do. do. Deferred	Stock	2s.	Nil	½%	12½%	19½ — 20½	19½ — 1½	19⅝	19½	— ½	8 17 3
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	..	..	5 %	..	99 —101	99 —101	..	..	..	4 19 0
44,000	Chili Telephone, Nos. 1 to 44,000	5	7 %	8 %	8 %	..	6½— 7½	6½— 7½	..	..	..	5 10 4
2,097,680	Commercial Cable Stlng. 500 year 4 % Deb. Stk. Red.	Stock	4 %	4 %	4 %	4 %	92 — 94	92 — 94	93⅜	92½	..	4 5 1
16,000	Cuba Telegraph	10	0 %	5 %	5 %	5 %	7½— 8½	7½— 8½	..	..	..	6 1 3
6,000	Do. 10 % Pref.	10	15 %	10 %	10 %	10 %	15½— 16½	15½— 16½	..	..	..	5 19 5
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	8⅜— 8⅝	8⅜— 8⅝	..	..	..	5 8 6
6,000	Do. do. 10 % Cum. Pref.	5	10 %	10 %	10 %	10 %	8½— 9½	8½— 9½	..	..	..	5 8 1
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
60,710	Direct United States Cable	20	3 %	3½%	4½%	..	15½— 15⅝	15½— 15⅝	15 11/16	15½	..	5 7 11
60,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	7 %	137 —142	136 —141	140⅜	138	—1	4 19 3
2,000,000	Do. 3½ % Pref. Stock	100	3½%	3½%	3½%	3½%	89 — 91	89 — 91	91	89½	..	3 16 11
1,896,706	Do. 4 % Mort. Deb. Stock Red. ..	Stock	4 %	4 %	4 %	4 %	104½—106½	104½—106½	106	..	..	3 15 2
800,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	7 %	13⅛— 13⅜ xd	13⅛— 13⅜	13⅛	13⅛	— ⅛	5 3 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	104½—106½	104½—106½	..	..	..	3 15 2
295,400	East & S. Afric. Tel., 4 % Mt. Db., 1 to 8,000, red. 1909	100	4 %	4 %	4 %	4 %	98 —101	98 —101	..	..	..	3 19 3
200,000‡	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	98 —107	98 —100	..	..	..	4 0 0
131,127	Globe Telegraph and Trust	10	5⅜%	5⅜%	5⅜%	5⅜%	11 — 11½	10⅞— 11⅜	11½	11	— ⅛	4 17 9
131,127	Do. do. 6 % Pref	10	6 %	6 %	6 %	6 %	13⅞— 14⅜	13⅝— 14⅜	14½	13⅞	..	4 3 6
150,000	Great Northern Telegraph, of Copenhagen ..	10	15 %	24 %	24%	20 %	84 — 86	84 — 86	..	..	..	5 11 1
33,500	{ Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red. }	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
17,000	Indo-European Telegraph	98	10 %	13 %	13 %	13 %	56 58	56 — 58	..	..	..	5 12 1
$41,880,400	Mackay Companies Common	$100	..	..	..	..	71 — 73	71 — 73	67½	..	..	..
$50,000,000	Do. do. 4% Cum. Pref.	$100	..	..	..	..	69 — 71	69 — 71	..	..	..	..
466,127	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	3/16— 7/16	3/16— 7/16	..	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	3 %	4 %	5 %	..	1 5/16— 1 7/16	1 3/16— 1 7/16	..	..	..	4 14 1
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	..	15/16— 1	15/16— 1	..	..	..	5 0 0
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	108 — 110	108 —110	109	108⅜	..	5 9 1
2,225 000	Do. do. Def. Stock	100	5 %	5 %	5 %	5½%	105 — 107	105 —107	106½	106	..	5 2 10
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	11½ — 13½	11½ — 13½	..	..	..	4 8 11
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	5 %	10 — 12	10 — 12	..	..	..	4 3 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5 5/16— 5 7/16	5 5/16— 5 7/16	..	..	..	4 9 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	95½ — 97½	96⅜ — 97⅜	..	..	..	3 11 10
1,389,398	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	100 —102	100 —102	102	101½	..	3 18 5
479,318	Oriental Telep. and Elec. 1 to 171,504, fully paid	1	6½%	6½%	7½%	7 %	1 5/16— 1 7/16	1 5/16— 1 7/16	..	..	..	5 4 4
60,000	Do. do. do. 6 % Cum. Pref. ..	1	6 %	6 %	6 %	6 %	1½— 1½	1½— 1½	..	..	..	4 16 0
100,000	Do. do. do. 4% Red. Deb. Stock	100	..	..	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
100,000	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	98 —101	98 —101	..	..	..	3 19 3
11,889‡	Reuter's	8	5 %	5 %	5 %	5 %	7½— 8¼ xd	7½— 8½	7½	..	..	4 14 1
60,000	Telephone Co. of Egypt, 4½ % Deb. Red.	100	..	..	4½%	4½%	99 —102	99 —102	..	..	..	4 8 8
8,167	Submarine Cables Trust	Cer	6 %	6 %	6 %	6 %	127 —130	127 —130	..	..	..	4 12 4
80,000	United River Plate Telephone	5	8 %	8 %	8 %	..	6⅞— 7⅛	6⅞— 7⅛	..	..	..	5 10 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	..	5 — 5⅛	5 — 5⅛	..	..	..	4 10 11
179,947	Do. do. 5 % Debs.	Stock	5 %	5 %	5 %	5 %	108½—111½	108½—111½	..	..	..	4 9 8
15,609‡	West African Telegraph, Shares	10	4 %	4½%	4 %	4 %	10 — 10⅜ xd	10 — 10⅜	..	..	..	3 16 2
80,008	W. Coast of America, 1 to 80,000 & 58,001 to 58,008	2	Nil	Nil	Nil	2½%	1⅛— 1⅜	1⅛— 1⅜	22/6	..	..	Nil
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..	3 18 5
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980 ..	10	7 %	7 %	7 %	..	13⅞— 14⅜	13⅞— 14⅜	14½	13⅞	..	4 19 1
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	102 —105	102 —105	..	..	..	3 16 2
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	3/16— 5/16	3/16— 5/16	..	..	..	Nil
84,668	Do. do. 6 % Cum. 1st Pref.	10	7 %*	6 %	5 %	8 %	7⅛— 7⅜	7⅛— 7⅜	7⅛	..	..	10 0 6
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	Nil	6½— 7½	6½— 7½	..	..	..	Nil
20,000	Do. do. 5 % Debs., Nos. 1 to 1,800	100	5 %	5 %	5 %	5 %	100 —103	100 —103	..	..	..	4 17 1

‡ Including arrears.

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

270,000	{ Anglo-Argentine Trams, Nos. 260,008 to 510,007, and 560,008 to 580,007		..	8 %	8 %	8 %	7⅞— 8⅜	7⅞— 8⅜	8 5/16	7 13/16	..	4 15 6
260,007	Do. 5½ % Cum. Prefs., 1 to 260,007 ..	5	5½%	5½%	5½%	5½%	5¾— 6	5¾— 6	5¾	..	..	4 11 8
266,600	Do. Permanent, 6 % Deb. Stock, 1888	100	6 %	6 %	6 %	6 %	133 —136	133 —136	134	..	..	4 8 3
385,100	Auckland E. Trams., 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	104 —107	104 —107	..	..	..	4 13 6
880,000	Babcock & Wilcox, 1 to 880,000	1	17 %	20 %	20 %	20 %	3¾— 4	3¾— 4	78/3	76/3	..	5 0 0
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 1/16— 1 3/16	1 1/16— 1 3/16	..	..	..	3 15 7
88,000	British Aluminium, Ord., 2,001 to 40,000	5	..	7 %	7 %	7 %	5 — 5⅛	5 — 5⅛ xd	..	..	— ⅛	6 7 3
40,000	Do. do. 7 % Cum. Pref...	5	Nil	7 %	7 %	7 %	5⅛— 5⅜	5⅛— 5⅜ xd	15 11/16	..	— ⅛	6 1 9
20,000	Do. do. "A" 6 % Cum. Pref.	5	Nil	6 %	6 %	..	5⅛— 5⅜	5⅛— 5⅜	..	..	..	5 4 4
20,000	Do. do. 4 % Funding Certs.	5	..	4 %	4 %	4 %	4 — 4½	3⅞— 4⅛ xd	..	..	— ⅛	4 14 1
258,000	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	..	100 —103	100 —103	..	..	..	4 17 1
800,000	Do. do. 5½ % Loch Leven Debs. ..	100	..	..	..	5½%	98 —101	98 —101	..	..	..	5 8 11
400,000	British Columbia E. Rail Def. Ord. Stock ..	100	6 %	6 %	6 %	6 %	123 —127	123 —127	123	..	..	4 14 6
300,000	Do. 5 % Pref. Ord. Stock	100	5 %	5 %	5 %	5 %	103½—108½	103½—108½ xd	..	..	..	4 12 2
800,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	102 —106	102 —106	..	..	..	4 14 4
228,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
220,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102½—104½	103 —105	..	..	+ ½	4 5 9
188,301	British Electric Traction	10	6 %	6 %	3 %	Nil	2⅜— 3⅛	2⅜— 3⅛	65/-	57/6	— ⅛	8 17 9
161,497	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	6 %	6⅛— 7⅛	6⅛— 7⅛	7 7/16	7 1/16	— ⅛	8 5 6
1,448,553	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	101 —104	101 —104	103	101½	..	4 16 2
410,178	Do. do. 4½ % 2nd Deb. Stock Red.	100	..	4½%	4½%	4½%	79 — 82	79 — 82 xd	..	..	..	5 9 1
100,000	British Insulated and Helsby Cables	5	8 %	8 %	8 %	10 %	6½— 6¾	6½— 6¾	..	..	..	7 8 2
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	5 15/16— 6¼	5⅞— 6⅛	5⅞	..	..	4 16 0
500,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
212,000	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	..	92 — 96	92 — 96	..	..	..	4 13 9
400,000	{ British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000 }	5	6 %	Nil	Nil	..	1 — 1⅛	1 — 1⅛	..	..	..	Nil
1,016,958	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	63 — 67	63 — 67	..	..	..	5 19 5
50,000	¶Browett, Lindley & Co., Ord.	£1	Nil	Nil	Nil	..	9/16— 11/16	9/16— 11/16	..	..	..	Nil
50,000	¶ Do. do. 6 % Cum. Pref.	£1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
105,781	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	Nil	Nil	3½%	Nil	1/16— 3/16	1/16— 3/16	..	..	..	Nil
150,000	Do. Non-cum. 6 % Pref.	2	6 %	6 %	6 %	Nil	1— 1⅛	1— 1⅛	..	..	..	4 18 11
125,000‡	Do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	88 — 91	88 — 91	..	..	..	5 15 5
125,000‡	Do. 4½ % Perp. 2nd Deb. Stock	Stock	4½%	4½%	4½%	4½%	75 — 78	75 — 78	..	..	..	3 12 9
100,000	Buenos Ayres & Belgrano, 1 to 100,000	5	8 %	4 %	8 %	3 %	3⅝— 4⅛	3⅝— 4⅛	79/4½	75/-	..	5 17 1
40,000	Do. "A" 6 % Cum. Pref., 1 to 40,000	5	6 %	6 %	6 %	6 %	4⅛— 5⅛	4⅛— 5⅛ xd	..	..	..	5 14 3
27,500	Do "B" do. 1 to 27,500	5	6 %	6 %	6 %	6 %	4¼— 5¼	4¼— 5¼ xd	..	..	..	4 6 11
13,200	Do. 5 % Deb. Stock	100	5 %	5 %	5 %	5 %	105 —115	105 —115	..	..	..	4 16 2
190,000	Do. 5 % 2nd Deb. Stock	100	5 %	5 %	5 %	5 %	101 —104	101 —104	..	..	..	5 3 8
137,610	Calcutta Trams., 1 to 137,610	5	6 %	8 %	8 %	8 %	7⅛— 8	7⅛— 7⅞	..	..	— ⅛	4 6 11
30,000	Do. 5 % Cum. Pref., Nos. 1 to 29,930	5	..	..	5 %	5 %	5⅛— 5⅜	5⅛— 5⅜	5⅛	..	..	4 4 1
850,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	104 —107	104 —107	..	..	..	6 13 4
85,000	Callender's Cable Construction shares	5	12½%	12½%	15%	15 %	10 — 11	9⅛ — 10⅜	..	..	— ⅛	4 6 11
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	5⅛— 5⅜	5⅛— 5⅜	..	..	..	4 2 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	106½—108½	106½—108½	..	..	..	Nil
491,222	Cape E. Trams., 1 to 491,222	1	10 %	5 %	Nil	..	3/16— 5/16	3/16— 5/16	86	..	— 1/16	6 8 0
450,000	Castner-Kellner Alkali, 1 to 450,000	1	4 %	4 %	6 %	8 %	1½— 1¾	1½— 1¾	24/3	..	..	4 8 3
224,988	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	..	97 —102	97 —102	..	..	..	4 5 7
911,568	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	4 %	70 — 72	73 — 75	75	73	+3	5 9 1
544,216	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	92 — 94	92 — 94	94	92½	..	4 5 1
544,216	Do. do. Def. do.	Stock	4 %	4 %	4 %	4 %	53 — 56	53 — 56	54⅜	53½	..	7 2 10
1,480,000	City and South London Railway	Stock	2½%	2½%	1¾%	2¼%	41 — 43	44 — 46	46¾	42½	+3	4 12 5
85,000	Crompton & Co., Nos. 1 to 85,000	5	2½%	2½%	2½%	..	1 1/16— 2 1/16	1 1/16— 2 1/16	..	..	..	3 14 0
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	96 — 99	96 — 99	..	..	..	5 1 6

* A period of nine months. † Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated, all shares are fully paid. § Interim dividends.
‖ And bonus of 10s. ¶ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—*(Continued.)*

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations June 11th.	Closing Quotations June 18th.	Business done week ended June 18th, 1907.		Rise + or Fall —	Present Yield per cent
		†	1903.	1904.	1905.	1906.			Highest	Lowest.		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	..	10 %	10 %	..	1 5/16 — 1 3/8	1 5/32 — 1 3/16	..	..	..	7 16 10
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000 ..	1	6 %	6 %	6 %	..	1 1/8 — 1 1/4	1 — 1 1/4	..	..	— 1/32	4 16 0
204,150	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
60,000	Dublin United Trams. (1896), 1 to 60,000	10	5½%	6 %	6 %	..	13½ — 14½	13½ — 14½	..	..	..	4 2 9
59,987	Do. 6% Pref. between 1 and 60,000	10	6 %	6 %	6 %	..	13 — 14	13 — 14	..	..	..	4 9 3
99,951	Edison & Swan Utd., "A" shrs., £8 pd., 1 to 99,951	5	Nil	2½%	4½%	..	1 — 1¼	1 — 1¼	22/6	..	..	10 0 0
17,189	Do. "A" shares, 01—017,189 ..	5	Nil	2½%	4½%	..	2¼ — 2⅜	2¼ — 2⅜	..	..	..	8 6 9
319,475	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	86 — 87	86 — 87	..	..	..	4 12 0
72,220	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	89 — 92	89 — 92	..	..	..	5 8 8
119,100	Electric Construction 1 to 119,100	2	4 %	Nil	Nil	..	¼ — 7/16	¼ — ⅜	..	..	— 1/32	Nil
81,890	Do. do. 7 % Cum. Pref., 1 to 81,890	2	7 %	7 %	7 %	..	1¼ — 1½	1¼ — 1½	..	..	— ¼	8 0 0
25,000	General Electric Co. (1900), 5 % Cum. Pref. ..	10	4 %	5 %	5 %	5 %	8¾ — 9	8½ — 8⅝	..	..	— ¼	5 11 1
200,000	Do. do. 4 % Mort. Deb. ..	Stock	4 %	4 %	4 %	4 %	92 — 95	92 — 95	..	..	..	5 14 8
78,000	Gt. N. & City Rail Pref. Ord. "A" 4 % 1 to 78,000	10	3 %	4 %	4 %	4 %	2¼ — 2⅜	2 — 2⅛	..	..	— ¼	20 0 0
96,000	Greenwood & Batley 7 % Cum. Pref.	10	7 %	7 %	7 %	7 %	10¼ — 10½	10¼ — 10⅜	..	..	..	6 13 4
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103	102 —103	..	..	..	4 17 1
200,000	Henley's (W. T.), Telegraph Works, Ord.	5	15 %	15 %	15%	15 %	11⅜ — 12⅝	11⅛ — 12⅛	11⅛	..	— ¼	6 0 0
200,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5¼ — 5⅜	5 — 5⅛	..	..	— ¼	3 17 3
150,000	Do. do. 4½ Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	105 —107 xd	105 —107 xd	106⅝	..	..	4 4 1
60,000	India-Rubber, Gutta-Percha & Telegraph Works..	10	10%	5 %	10%	10 %	15 — 16	15 — 16	..	..	..	6 5 0
87,500	†Liverpool Overhead Railway, Ord.	10	12%	12%	Nil	Nil	1¼ — 1⅜	1⅛ — 1⅜	..	..	..	Nil
10,000	† Do. do. Pref. £10 paid	10	5 %	5 %	5 %	5 %	6¼ — 7⅛	6⅛ — 7⅛	..	..	..	6 13 4
600,070	London United Trams (1901), 1 to 50,007 ..	10	8 %	6 %	8 %	8 %	6¾ — 7⅛	6⅞ — 7⅛	..	..	..	8 8 7
399,980	Do. do. 50,008 to 100,000	10	8 %	6 %	8 %	8 %	7 — 7⅛	6⅞ — 7⅛	..	..	— ¼	5 2 2
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000 ..	10	5 %	5 %	5 %	5 %	7⅞ — 8⅛	7⅞ — 8⅛	8 7/16	..	..	5 14 8
1,831,000	Do. do. 4 % 1st Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	84 — 88	84 — 88	..	..	..	4 10 11
314,016	Metropolitan Electric Trams, Defd.	1	Nil	Nil	Nil	Nil	3/16 — 5/16	3/16 — 5/16	2/-	..	..	Nil
500,000	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	3/16 — 5/16	3/16 — 5/16	18/9	16/10½	..	5 3 11
350,000	Do. 4½ % Deb. Stock Red.	100	..	4½%	4½%	4½%	96 — 99	96 — 99	..	..	..	4 10 11
80,000	Peebles (B.) & Co. 6 % Cum. Pref., 20,001 to 50,000	5	..	6 %	6 %	6 %	3⅞ — 4⅛	3⅞ — 4⅛	..	..	..	7 1 2
245,500	Potteries E. Trc.	1	5 %	5 %	4 %	4 %	3/16 — 5/16	3/16 — 5/16	7/6	..	..	6 8 0
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	3/16 — 5/16	3/16 — 5/16	..	..	..	6 13 4
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
87,850	Telegraph Construction and Maintenance ..	12	20 %	15 %	15 %	15 %	80 — 82	80 — 82	20⅝	30½	..	5 13 2
150,000§	Do. 4 % Deb. Bds., 1 to 1,500 Red. 1909	100	4 %	4 %	4 %	4 %	101 —104	101 —104	..	..	..	3 16 11
599,200	Undergd. E. R., Lon., 5 % Profit Shar. S. Nts. ..	..	..	5 %	5 %	5 %	70 — 73	67 — 70	68½	65	—3	7 2 10
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	5	8 %	Nil	Nil	..	1¼ — 1⅜	1⅛ — 1⅜	30/-	26/3	..	Nil
66,666	Do. 6 % C. P., 80,001 to 80,000 & 125,001 to 141,666	5	6 %	Nil	Nil	..	3⅜ — 4⅛	3¾ — 4	77/6	74/-	— ⅛	Nil
246,574	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	78 — 82	77 — 81	..	..	—1	4 18 9

ELECTRICITY SUPPLY COMPANIES.

14,000	Bromley (Kent) E.L. & P., 1 to 14,000	5	5 %	5⅓%	5⅓%	5⅓%	4⅞ — 5⅛	4⅞ — 5⅛	..	..	..	5 4 9
70,000	Do. do. 4½ % 1st. deb. stock ..	100	4½%	4½%	4½%	4½%	97 — 99	98 —100	..	..	+1	4 10 0
29,798	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10 %	10 %	10%	8 — 9	7⅞ — 8⅛	..	..	— ⅛	6 1 3
10,202	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	4 2 4
336,876	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply ..	5	8 %	8 %	5 %	5 %	3 — 4	3 — 4	..	..	..	6 5 0
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4 — 4½	4 — 4½	..	..	..	5 0 0
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅞ — 4⅛	3⅞ — 4⅛	..	..	..	5 5 11
427,400	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	96 — 99	94 — 97 xd	..	..	—2	4 2 6
49,496	Chelsea Electricity Supply, Ord.	5	5½%	6 %	6 %	4½%	3⅞ — 4⅛	3⅞ — 4⅛	..	..	..	4 14 9
175,000§	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½%	4½%	4½%	4½%	103 —106	103 —106	103	..	..	4 4 11
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	5 %	6 %	6 %	6 %	9⅛ — 10⅛	9 — 10	9 7/8	9⅛	— ⅛	6 0 0
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11½ — 12½	11½ — 12½	11 1/16	..	..	4 18 0
400,000§	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	123 —126	123 —126	..	..	..	3 19 4
200,000	Do. 4½ % 2nd Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
40,000	County of Durham Electrical Power, Ord.	5	4 %	£8 7 0	4 %	4 %	4½ — 5	4½ — 5	..	..	..	4 0 0
50,000	Do. do. do. 5 % Pref. ..	5	5 %	5 %	5 %	5 %	4⅝ — 5	4⅝ — 5	..	..	..	5 0 0
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4 %	4½%	5 %	5 %	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	5 17 8
40,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10½ — 11½	10½ — 11½	11 3/16	11 1/16	..	5 4 4
400,000§	Do. do. 4½ % Deb. Stock ..	..	4½%	4½%	4½%	4½%	106 —109	106 —109	107½	106	..	4 2 7
400,000	Do. do. 4½ % 2nd Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	94 — 97	93 — 96	..	..	—1	4 13 9
80,000	Edmundson's Electric Corporation, Ord. Shares ..	5	7 %	7 %	4 %	..	½ — 1½	½ — 1	..	..	— ¼	11 0 0
80,000	Do. do. 6 % Cum. Pref. ..	5	6 %	6 %	6 %	..	1⅝ — 2⅜	1⅝ — 2½	38/9	38/1½	..	12 0 0
350,000	Do. do. 4½ % 1st Mort Deb. Stk	100	4½%	4½%	4½%	4½%	78 — 83	78 — 83	..	..	..	5 0 0
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅞ — 6⅜	4⅞ — 6⅜ xd	..	..	..	5 8 5
10,000	Do. 5 % Cum. Pref., 1 to 10,000 ..	5	..	..	5 %	5 %	5 — 5⅜	5 — 5⅜	5	..	..	4 15 8
90,000	Do. 4½ % 1st. Deb. Stock	100	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
18,000	Hove, 1 to 18,000	5	8½%	8½%	9 %	9 %	7 — 7½	7 — 7½ xd	..	..	..	6 0 0
21,000	Kensington and Knightsbridge Electric Ord. ..	5	12½%	12 %	10 %	10 %	8¾ — 9¼	8¾ — 9¼	..	..	..	5 0 0
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	4 0 0
111,000	London Electric Supply Corporation, Limited, Ord.	3	Nil	3 %	4 %	4 %	1⅜ — 2⅛	1⅜ — 2⅛	..	..	..	5 6 8
70,000	Do. do. do. 6 % Pref...	5	6 %	6 %	6 %	6 %	4⅛ — 5⅛	4⅛ — 5⅛	5	..	— ⅛	5 17 1
874,396	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4 %	4½%	95 — 98	98 — 96 xd	94⅛	94	—2	4 13 9
200,000	Metropolitan Electric Supply, 1 to 100,000	5	8½%	10 %	10 %	8 %	5⅜ — 6⅜	6 — 7	6⅜	..	+ ⅛	5 14 3
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅞ — 5⅛	4⅞ — 5⅛	..	..	..	4 3 9
220,000§	Do. 4½ % 1st Mort. Deben. Stock ..	..	4½%	4½%	4½%	4½%	105 —109	105 —109	..	..	..	4 2 7
250,000§	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	88 — 93	88 — 93	..	..	..	3 15 3
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	97	..	..	4 11 10
67,991	Newcastle-on-Tyne	5	8 %	8 %	8 %	8 %	7⅛ — 7⅜	7⅛ — 7⅜	..	..	..	5 3 3
75,000	Do. 5 % Pref., 1 to 75,000	5	5%	5 %	5 %	5 %	5 — 6	5 — 6	..	..	..	4 3 4
10,853	Notting Hill Electric Lighting	10	6 %	7 %	7½%	7½%	12 — 13	12 — 13	..	..	..	5 15 5
20,000	Oxford, 1 to 96 and 407 to 20,310	5	6½%	7 %	7 %	7 %	6 — 6½	6 — 6½	..	..	..	5 7 8
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	96 — 98	96 — 98	..	..	..	4 1 8
40,000	St. James' and Pall Mall Electric Light, Ord. ..	5	14½%	14½%	12½%	10 %	7⅜ — 8⅛	7⅜ — 8⅛	..	..	..	5 17 8
20,000	Do. do. 7 % Pref. 20,001 to 40,000	5	7 %	7 %	7 %	7 %	6⅝ — 7⅛	6⅝ — 7⅛	..	..	..	4 13 4
150,000§	Do. do. 3½ % Deb. Stock Red. ..	100	3½%	3½%	3½%	3½%	88 — 93	88 — 93	..	..	..	3 15 3
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	4 %	4 %	Nil	1½ — 2½	1½ — 2½	..	..	..	Nil
80,000	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	73 — 77	73 — 77	..	..	..	5 3 11
65,000	South London Electricity Supply, Ord.	5	3 %	4 %	4 %	3 %	2 — 2⅜	2 — 2⅜	41/3	40/-	..	6 0 0
190,000	South Met. Elec. Lt. & Power, Ord.	1	Nil	Nil	2½%	2½%	5/8 — 3/4	5/8 — 3/4	..	..	..	3 6 8
117,968	Do. Do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1⅝ — 1¾	1⅝ — 1¾	..	..	..	5 1 10
200,000	Do. Do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	1⅜ — 2⅛	1⅜ — 2⅛	..	..	..	10 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	2⅜ — 3⅛	2⅜ — 3⅛	61/3	..	..	7 2 10
200,000	Do. do. 4½ % 1st Mort. Db. Stk. Red	100	..	4½%	4½%	4½%	94 — 97	94 — 97	..	..	..	4 12 9
110,000	Westminster Electric Supply, Ord.	5	18½%	14 %	18 %	12 %	9 — 10	9 — 10	9 1/16	9⅛	..	6 0 0
81,279	Do. do. 4½ % Cum. Pref. ..	5	5 %	5 %	5 %	4½%	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	3 18 3
	(Original 5%—Red. to 4½ % from 31st Dec., 1905.											

Unless otherwise stated all shares are fully paid. § Interim dividends.

Bank rate of discount 4 per cent. April 25th, 1907.

ADEQUATE DEPRECIATION OF CAPITAL EXPENDITURE BY MUNICIPAL ELECTRICITY UNDERTAKINGS.

By J. HORACE BOWDEN, Borough Electrical Engineer and Manager, and
FRED TAIT, Managerial Assistant, Metropolitan Borough of Poplar.

There is probably no subject that commands more serious consideration by the management of municipal electricity undertakings than the matter of adequate depreciation of capital expended in the establishment of such enterprises.

There is a very wide divergence of opinion as to what adequate depreciation really is. It is sometimes considered sufficient merely to comply with the statutory requirements for redemption of loans, but unless loans are granted for periods equivalent to the "lives" of the assets, the actual repayments do not bear any relationship to adequate depreciation. These remarks particularly apply to Metropolitan boroughs, where, with the exception of meters and land, loans have been up to the present date granted on an equated period of 42 years. Similar conditions do not prevail in the provinces, but the principles of depreciation which the writers will endeavour to set out in this article, will apply equally to Metropolitan and to provincial authorities.

It must be obvious to anyone that it is necessary to expend an amount of capital commensurate with the requirements of the area of supply, in order fully to cope with the demands upon any undertaking, and that the expenditure must be of gradual growth in exact proportion to the growth of the demand. Any large amount of expenditure in anticipation of distant future demands creates a heavy standing charge upon present consumers, and should therefore be carefully avoided, but in the initial stages of the life of an undertaking this cannot be avoided, and, therefore, not only must the charges for the supply of energy be high, but the amount of surplus, after payment of interest charges, must necessarily be low, and, consequently, the provision for depreciation will be totally inadequate.

The writers have come to the conclusion that it is impossible for any undertaking, charging equitably for the supply of energy, to made adequate depreciation within a period of 20 years from the commencement of supply, which period, they submit, should be divided into four stages of three, three, seven and seven years.

In the first stage it is only reasonable to expect a profit sufficient to meet the interest charges upon the initial capital expended. In the second stage, when probably the initial capital expenditure has been doubled in order to cope with the demand, it is satisfactory if depreciation has been effected equivalent to 50 per cent. of the amount required for "adequate depreciation." In the third stage, the total depreciation during the seven years should equal the aggregate adequate depreciation according to a standard law of depreciation based on the "lives" of the various assets, and in the fourth stage, the total depreciation should equal adequate depreciation plus the difference between adequate and actual depreciation during the first and second stages.

In arriving at conclusions from the above stated premises, it is obvious that any system of compulsory redemption of loans will not allow for practical and also adequate depreciation; but if the establishment of a sinking fund upon a fixed standard of depreciation be made compulsory, it is immaterial whatever system of redemption may be adopted, or, in fact, it should be seriously considered whether annual redemption of loans is practicable at all, because if viewed as redemption, it is certainly not depreciation. It is the dream of some municipal traders that, when the demands of a given area are fully supplied, and capital expenditure ceases, an undertaking in the course of years will be handed down to posterity free from all debt, and that the supply of energy will ultimately be freed from all interest charges. Such a policy (even if it could be practicable) is, undoubtedly, unfair to the present generation, which would thus be taxed for the benefit of posterity; but if the said policy is accepted, then the redemption fund must be in addition to the sinking fund, and the writers are not aware of any authority at the present moment making provision for the realisation of such a policy. If, however, on the other hand, redemption of loans may be treated as depreciation (and we have it, at a recent inquiry at Bermondsey, on the authority of one of the Local Government Board auditors, that it may), then the whole system of redeeming loans is farcical, as the redemption fund is then a sinking fund which is invariably totally inadequate.

Assuming that the latter view is the correct one, it would be of distinct advantage to all local authorities if definite terms of life for all classes of assets were fixed under a standard of depreciation by a responsible body of engineers, such as the I.E.E., representing every branch of the electrical industry, or the I.M.E.A., representing the municipal undertakings, in conjunction with the L.G.B. and the L.C.C., and in accordance with the same, it should become compulsory on the part of each undertaking to carry annually to the debit of a "sinking-fund account" the due proportion of each asset, and that, when the undertaking has sufficiently developed, a sum be included in the annual estimates of each undertaking to meet the ascertained amount of depreciation, less the amount of redemption of loans. In the early years of the life of each undertaking, the debit balance of this account would assume large proportions, as it would be found impracticable to charge for supply at a price equivalent to the amount required for sinking fund; but as the scope of the undertaking extended, the adverse conditions would be gradually overcome in, say, 20 years, as previously stated.

The capital thus accumulated under sinking fund should be invested annually in trustee securities, and the income derived therefrom placed to the credit of revenue account, provided that the rate of interest obtainable is equal to, or greater than, that at which new loans can be raised: but if it is found, when fresh capital expenditure is necessary, that the money market is high, then the wisest course to be adopted by local authorities would be to seek the sanction of the controlling authorities to realise on securities and devote the proceeds to the necessary expenditure, and to raise the additional capital at a more opportune time when the money market is favourable.

Undoubtedly, much difficulty will be experienced in fixing a standard of depreciation based on the lives of electricity assets, as the opinions of no two engineers will be completely coincident, but if the whole subject is conscientiously considered by the members of either of the associations referred to, and the opinions of the majority considered in connection with each item of expenditure, a satisfactory conclusion should be arrived at.

In the first place, the number of allocations should be limited as far as possible, and the lives equated under each allocation. There is, in the writers' opinion, no practical value in splitting up machinery under various lives. It is a matter of conjecture whether a turbine has a shorter life than an engine, a dynamo than an alternator, or a boiler than a pump, as the future wear and tear upon a given piece of plant is an unknown quantity, and the working hours of any plant unit are entirely dependent upon the demands of the load.

In the case of mains it is somewhat different. The cost of ducts, including excavating and re-instating, may be depreciated more gradually than similar work in connection with those laid on the solid system.

The following schedule of allocations may, perhaps, be found sufficient for all practical purposes, viz. :—

1.—Land.

2.—Permanent buildings.

2A.—Temporary buildings.

3.—Machinery.

4.—Mains, including all cables, excavating and re-instating on solid system, and services.

4A.—Mains ducts, including excavating and re-instating and street boxes.

4B.—Services.

5.—Meters, instruments, tools and office furniture.

6.—Preliminary and extraordinary expenditure.

7.—Accumulators.

The writers have not the temerity to lay down any fixed periods as the "lives" of the foregoing assets, but they do propose to submit periods for depreciating the capital expended on the same, as follows :—

1. *Land.*—The question of life does not enter into the consideration of this asset, and if the sites are carefully chosen, the very nature of the industry created, viz., the generation and distribution of light, power and heat, puts all question of depreciation out of court, and it is probably a debatable point as to whether a sum should not be carried to the credit of sinking-fund account for the appreciation of this asset. It has occasionally been pointed out, that should such a contingency arise as the abandonment of the present system of electricity supply and place be given to any new system of distribution that may be discovered in the future, the cost of razing the buildings may have a deleterious effect on the value of the land. This contingency possibly, though not probably, may arise, but as it is not within the province of depreciation, it must be considered later, in its relationship to reserve fund, which is a totally different subject. The capital value of land therefore, if the redemption policy is ignored, should not be depreciated.

2. *Permanent Buildings.*—Here again the question of life does not enter largely into consideration. The stone, bricks and mortar and steel work will probably live the 50, 60, or even 100 years, as laid down by some authorities, but who will venture to say that many of the present palatial buildings, with their beautifully-glazed walls and mosaic-paved floors, will not be altered beyond all recognition, say, 20 years hence? Floors are pulled up to provide for larger sets, walls are knocked down to extend boiler houses, &c.; therefore, the policy of to-day in spending large amounts of money on expensive buildings is to be condemned. The permanent work should, of course, be built as substantially as possible, and if the allocation of the cost is kept separate from foundations for plant and temporary walls, depreciation, based on 60 years' life or more, will probably be found to be quite adequate.

2A. *Temporary Buildings.*—Foundations for plant and temporary walls should be allocated separately and depreciated in a similar manner to the plant, on account of which this capital is expended.

3. *Machinery.*—The items of plant allocated under this heading are multifarious, and, as previously stated, it is impossible to forecast the amount of wear and tear upon each unit; an equation must therefore be made which, if fixed at 20 years, will, no doubt, be adequate. There are instances where engines and other plant have been in general use for upwards of 15 years, and are still doing useful work. The antiquation of the plant and its residual value must not be taken into consideration in connection with depreciation, as these matters must be dealt with in their relationship to reserve fund.

No article on depreciation would be complete without reference to spare parts of machinery. Hitherto the sanctioning authorities have religiously set their faces against any loans to cover expenditure of this description, if purchased specifically as spares, but have raised no objection when such have been included in original contracts. Looking at the subject in a broad light, all reserve plant is spare, but whilst loans are sanctioned for the duplicate of the largest generator or boiler, a spare armature, saving the installation of a duplicate motor or dynamo, is treated as revenue. The natural consequence of this treatment has been that authorities have adopted the course of placing spares in stock account, which is not depreciated in any way, and the asset thus bears a fictitious value in the books of the undertakers.

4. *Mains.*—Here the life is perhaps of a more speculative character than in the case of machinery, as the history of the industry is too recent to supply us with the requisite data for fixing a standard. Thirty years has been suggested by a number of engineers as the probable life, and for the purpose of depreciation, this term may suffice.

4A. *Mains Ducts.*—These being of the nature of permanent buildings, depreciation may be made in a similar manner.

4B. *Services.*—In the case of power supply undertakings, services incurring considerable capital expenditure are necessary, and any system of depreciation allocating a shorter life than 30 years to this class of expenditure would seriously and unnecessarily affect the price charged for energy to power consumers, and so handicap the progress of the undertaking. In a lesser degree these observations also apply to lighting consumers; therefore, as the nature of the asset up to the cut-out is similar to that of ordinary mains, it is quite safe to assume a 30 years' life in general.

5. *Meters, Instruments, Tools and Office Furniture.*—Ten years is the generally accepted life of these assets, and if movable instruments only are allocated under this heading, whilst switchboards are treated as machinery, 10 years should suffice.

6. *Preliminary and Extraordinary Expenditure.*—It periodically occurs that considerable expenditure is necessitated in the course of extensions which provides no visible assets. This will invariably occur, as all plant must be modified to become adaptable to the additional installations, and as such modifications are made for the purpose of increasing the revenue-earning capacity of the plant, it is apparent that no one year in particular should be saddled with the cost of the same, which should be spread over, say, 10 years, by placing the cost to capital account and depreciating at the rate of 10 per cent. per annum. This system should apply to the cost of raising loans and all other expenditure of the nature of preliminary expenditure.

7. *Accumulators.*—The life of this class of asset arouses discussion of a very contentious nature, into which the writers do not propose to enter. Most undertakings have probably found, after a period of, say, five to seven years, that their value as a revenue-earning asset has ceased, as after the load has been built up, the loss in efficiency and the short life of the plates does not warrant their use, and the cost, therefore, should be written off in, say, five years.

It is important at this juncture to make clear to the minds of those concerned in the management of municipal undertakings that, for the purpose of adequate depreciation, the estimated life of each plant unit is not of such paramount importance. It is immaterial to the undertaking if, at the end of any given period, there is found a debit balance against, say, machinery should a compensating balance stand to the credit of, say, mains.

Twenty years has been mentioned as the earliest period in which adequate depreciation can be provided; then, again, if on valuation of the assets it is found that the system based upon the agreed periods of life is inadequate, further provision to cover such inadequacies may be made during a further stage. It may be argued—If this statement is accepted, why trouble with various allocations? Why not carry annually to a sinking fund a fixed percentage of capital expenditure each year, as is now done in many businesses? The result in, say, 20 years would probably be the same, but the benefits of separate allocation of depreciation are manifold. The industry, although now past the experimental stage, is still young in the commercial world, and it will be many years before the full possibilities of the use of electricity are reached, therefore the capital required to lay down generating machinery and the distributing system necessary to cope with this increasing demand within any given area will also be on the increase.

In the inital stages the cost of land and buildings bearing the smallest percentage of depreciation will be in greater proportion to the total expenditure than in the final stage of the 20 years stated, thus a fixed percentage per annum over the whole period would not be adequate depreciation.

By separately allocating depreciation, it is possible to ascertain at the commencement of each financial year, the exact extent to which it is possible to extend in any direction during the forthcoming year, without adding to the outstanding capital, a circumstance which must commend itself to the management of any undertaking, as it is evident that if a profit is made in any one year with a given capital, should the capacity of the plant be extended without increasing the capital charges, the undertaking will be in a better position to earn an increased revenue.

Whilst dealing with the subject of adequate depreciation, it is necessary to touch upon the necessity of establishing a reserve fund in addition to a sinking fund. The objects of the two funds are very often confused, and, indeed, it has never yet been clearly stated what are the distinguishing features of each. The writers submit that whilst sinking fund provides for future capital expenditure, not, of course, including capital for the extension of the scope of the undertaking, the reserve fund provides an insurance against extraordinary revenue expenditure. It is probable that in

the future when the cost of production is brought down to the irreducible minimum, and the price charged for energy is in accordance with the same, and the coal at a low market rate, then any sudden rise in price of coal, such as has occurred at the present time, would necessitate an advance in the price charged; but as it would be prejudicial to the interests of the undertaking to adopt such a course (the advance probably being only of a temporary nature), the advantage of being able to draw upon the reserve to meet any deficiency is obvious.

In the circumstances previously mentioned in relation to the life of land where an undertaking had been abandoned, and the cost of razing buildings would be charged upon the local authorities, any balance of reserve fund would be held until the sale of land was completed, as the provision against such contingency, before absorption in the general rate.

In the event of any plant unit becoming obsolete before the completion of its standard life, the difference between the original cost and the provision made for depreciation plus residual value would be a charge upon the reserve fund. In the event of the amount provided by depreciation plus residual value exceeding the original cost, the difference should be carried to the credit of the reserve fund.

As the extent of insurance should be limited as far as possible to provision against fire, boiler explosions, first, or first and second, years' maintenance of new plant, and compensations to workmen, a number of contingencies may arise which cannot be estimated at the commencement of the financial year, and which should be chargeable on reserve fund. Where this fund is in existence, the manager is enabled to present much closer estimates than he would otherwise do if such estimates provided against contingencies which, though probable, might possibly not arise.

This fund should also provide a sufficient working balance to enable the undertaking to carry an efficient stock, give the necessary credit to consumers, and avail itself of the cash discounts of merchants' accounts without overdrawing on bank account.

From the preceding portion of this article, it must be perceived that the subject of adequate depreciation is a matter of equal importance to the accountant as to the engineer, although the effective administration of the same is a matter of greater interest to the engineer, and any article or paper on the subject that does not deal with the financial issue of the suggestions made is of little practical value.

(*To be continued.*)

AMERICAN METER METHODS.

On January 16th, 1907, before the North-Western Electrical Association of Chicago, an interesting paper, entitled "Warrantable Expense for Meter Testing," was read by Mr. Oliver J. Bushnell, superintendent of the meter department of the Chicago Edison Co.

The paper is divided into four sections:—Periodic tests, installation tests, methods of testing, and cost of testing. Under these heads the author discusses the changing, testing and overhauling of meters at regular intervals; the testing of meters *in situ*; four methods of arrangements by which meters can be tested; and the amount of money which may legitimately be expended in keeping meters in a reasonably accurate condition.

As regards periodic testing, Mr. Bushnell divides meters into two chief classes—commutator meters and induction meters—and of these the first class are more liable to go wrong than the second. The principal causes of inaccuracy in meters are, he points out, wear of jewels and pivot; ageing of magnets; commutator and brush troubles; and conditions of installation, meaning vibration, dampness and dust. The wear of jewels and pivots is obviously greater in a meter whose moving part is heavy. Weakening of magnets through short-circuits is more liable to occur where the current passes through field coils set about a wound armature, than where they are arranged on the other side of a screen, as in the case of most induction meters. In the first case the brake magnets are often directly in the path of the field set up by the main current. Commutator and brushes are non-existent in induction meters, and their troubles disappear in consequence. Vibration, dampness, dust, and other conditions are more likely to produce sparking at, and dirtiness of, the rubbing contacts than anything else.

Sapphire jewels need changing after about 1,000,000 revolutions for commutator meters, but the light disk and shaft of an induction meter may be safely allowed to revolve 2,000,000 times. Diamond jewels last quite five times as long, but tend to wear the pivots out. Mr. Lyman C. Reed, in his "American Meter Practice" (New York: McGraw Publishing Co., 1903), recommends changing jewels, whether they apparently need it or not, once every two months, reissuing good jewels, and discarding those which are worn or cracked.

In respect of commutator meters, the following is the author's classification:—

"Annual tests for meters of 5 or 10 amperes capacity.

"Semi-annual tests for meters of 15 to 20 amperes capacity.

"Quarterly tests for meters of 75 amperes capacity and above.

"Meters making over 1,000,000 revolutions of the disk between tests on above classification to be exchanged to more frequent class, so as not to exceed that number between tests, up to the quarterly class."

Those in the quarterly class are equipped with diamond jewels, and those tested half-yearly are in process of being similarly fitted.

It would be interesting to know what has been Mr. Bushnell's experience with ball footstep bearings, and how many revolutions a hard steel ball working in a sapphire or a diamond jewel may safely be allowed to make. The writer is of opinion that the life of the bottom bearing—pivot and jewel—is approximately doubled.

An instructive paragraph is that in which the author gives his experience as to the retention of accuracy by meters in the different classes:—

	One-half load. Per cent.	One-tenth load. Per cent.
Annual tests	97·3	89·6
Semi-annual tests	97·8	90·8
Quarterly tests	99·1	96·5

Induction meters have hitherto been tested annually, but Mr. Bushnell suggests that the larger meters and those making more than 3,000,000 revolutions between tests may be tested on a half-yearly basis.

In 1904, at the Derby Convention of the Incorporated Municipal Electrical Association, the writer ventured to advocate the changing of meters every two *years*, and one of my critics was surprised, remarking that there ought to be plenty of room provided for a scrap heap, for he thought that meters which required changing so often were useless. One feels inclined to say, with Tom Hood:—

> What do you think of that, my cat?
> What do you think of that, my dog?

The testing of meters after fixing is a subject which Mr. Bushnell develops to some extent, and anyone who has had experience of the erratic way in which meters behave between their work and the test room, or *vice versâ*, will realise that if some reliable and flexible method of carrying out tests on meters in position, throughout their working range, could be devised, it would prove most useful. But when meters vary in capacity from 3 amperes to 600 amperes, and from 50 volts to 2,000 volts, it is evident that a universal testing set would be somewhat cumbrous. Sometimes a meter which is good in the test room refuses to go when fixed, and when brought back it is good again. Of course, this means that a defect has been developed in transit, and cured by disturbing the meter, and when meters are liable to offend in this way, the advisability of testing them on the consumer's premises is obvious.

Two of the largest supply companies in America make a test on every meter installed before the first bill is rendered.

There are practical difficulties in the way of carrying out such tests, for if we adopt the method advocated by Mr. L. C. Reed, of hanging a standard meter to the consumer's meter by means of a chain and hooks—certainly a good way, for the consumer can easily understand that his meter is right

when it swings round in step with the standard—how are we to be sure that the standard meter does not change in calibration during transit? Besides, in the room which is sometimes afforded for the supply apparatus there is frequently no space for anything else. Again, if we try to test with indicating wattmeter and stop-watch, stooping beneath a pork butcher's bench, with brine and soapy water trickling down one's neck, the process is the reverse of enjoyable, and is liable to introduce "errors of observation."

The methods of testing described are four :—

1. With ammeter, voltmeter and stop-watch.
2. With calibrated resistance, voltmeter and stop-watch.
3. With indicating wattmeter and stop-watch.
4. With check recording wattmeter (watt-hour meter).

Of these, the first can only be used on direct-current circuits, and the second is like unto it, unless the resistance is absolutely non-inductive. The third is suitable for alternating-current circuits, but is liable to be disturbed in the case of direct current if external magnetic fields are present. Check meters built with several field windings are mentioned by the author, but the present writer has to confess that these have not been brought to his notice.

Mr. Bushnell arrives at an average annual cost of 3s. for every induction meter installed, and 6s. for each commutator meter. This latter figure is due to the higher cost of diamond jewels which are fitted to many commutator meters, as indicated above. But the author thinks the expenditure justifiable, for he has netted over $85,000 (£17,000) extra from the reduction in units lost in distribution alone, and in a case nearer home than that, 2 per cent. on 500,000 units is £27 1s. 8d., even at ·65d. per unit.

In a typically American discussion which followed, it was revealed that one fortunate engineer sold his old meters, euphemistically termed "junk," for 10s. or 12s. each. About twice as many pence is a good figure to get on this side.

Meters seem to keep their accuracy here within reasonable limits for two years, and if carefully treated they will not need changing oftener.

A good check is kept on the accuracy of a meter by having a first-rate clerk to enter up the meter readings. When the card system is used, so that a consumer's account for a year is before the clerk's eyes every month, any discrepancy between the registration now and during the corresponding period of last year is apparent. A good deal of meter inspection can be done from the office stool, and it does not do to tinker with meters on consumers' premises. Perhaps cleaning up and jewel changing may put matters right for a month, but the trouble is bound to recur, and then the account has to be averaged, and in all probability the consumer is permanently aggrieved, for ever afterwards regarding the supply authorities as swindlers.

Suspicion is engendered in the minds of consumers when inspectors go to their shops and houses and open the meters and poke about inside them; it has often been said to the writer: "Your man was here looking at the meter the other day, don't your people think we are using enough stuff?" That precious jewel, the confidence of the consumer, should not be rashly thrown away, even for a cupped diamond.

There is no reference in the paper, nor has the writer been able to find any in other places, to the life of a meter, by which is meant the length of time between the purchase of the meter and its consignment to the scrap heap. There are meters in Sheffield to-day which were bought over 12 years ago, and which are still fit to use, and the writer has no doubt that other towns can show a similar state of things. The life of a meter may be taken as not less than 10 years, if it is treated with reasonable care.

Prices are much lower now than was the case even so short a time as seven years ago, but this does not necessarily mean that quality has been sacrificed. The amount of business done in meters, the largely increased demand for them, and the consequent improvements which it has been necessary to make in methods of manufacture, are all factors which help to bring about reduction in the price. In view of past experience, then, it does not seem fair to restrict the period for which money may be borrowed for meter purposes to five years, or to force supply authorities to purchase new meters—except for renewals—out of revenue. A. J. C.

AIR SLIPPER BRAKES.

While the use of compressed air brakes for tramway cars is common on the Continent and in the United States, the matter has not received much attention in this country. At the present time the whole question of tramcar brakes is a subject of special interest, and the system is quite deserving of careful consideration.

It is universally admitted that, with the higher speeds and heavier cars that are now usual, some form of power brake which does not call for undue exertion on the part of the driver, and which is preferably independent of the wheels, is very necessary. The brake should be reliable, instantaneous in its action, and capable, in emergency, of making a very sharp stop with as little damage to the car and its equipment as possible. The working parts should be as few and as simple as possible, and the cost of maintenance should be low.

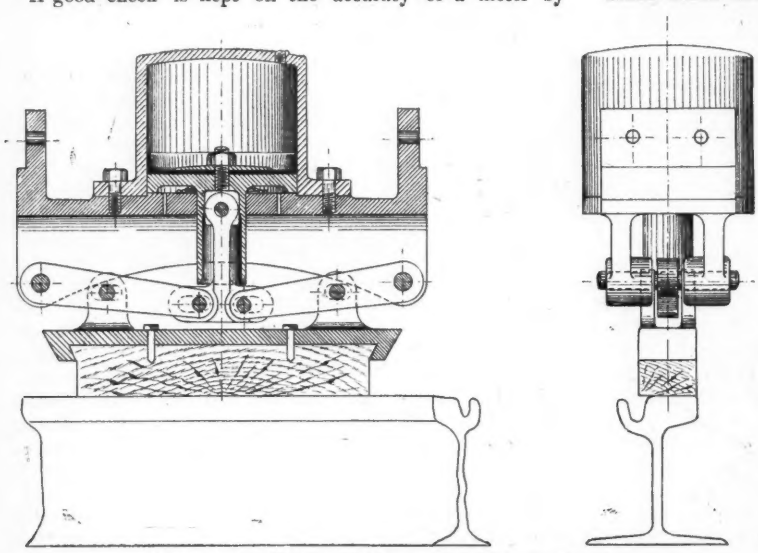


Fig. 1.—The Hewitt & Rhodes Air-Slipper Brake.

The air slipper brake possesses most of these characteristics, and has only been open to question as to its perfect reliability and its maintenance costs. As regards the former, there is no reason why air piping should not be as free from defects as, say, insulated cable, and the extensive and successful use made of compressed air for railway braking work, shows that, under severe conditions, reliability can be assured. The maintenance of the brakes has been, however, in many cases a serious item, more particularly as regards the compressor equipment. The general practice has been to fit each car with a separate small compressor, and this by reason of the limited space available, and the necessity for reducing the first cost, has not always been of a first-class design. The tramcar compressor is usually gear-driven from the axle, but in some cases a small motor-driven compressor is installed. The latter arrangement is much preferable, and is almost invariably used for electric railway work, but the high first cost and the difficulty of finding space, renders its adoption for tramway work almost prohibitive.

It is quite possible that, in many cases, some air storage system will most economically meet the requirements, as in this case the compressor is transferred from the car to a stationary position, where it can be of a larger and more efficient type, and where the conditions are much more conducive to reliable working.

The majority of air brakes are, of course, used in

connection with the ordinary wheel shoes, and while this allows of a powerful and rapid braking action, the liability to skid the wheels by unskilful use is existent. For tramway work, therefore, the air should be used preferably in connection with a track brake, and the form shown in fig. 1, as designed by Messrs. Hewitt & Rhodes, is the most widely known. This form of brake has been in existence for some time, and has been adopted in one or two places, the most extensive use having been made on the cars of the Potteries Co.'s system. In 1899 and 1900, about 50 of this company's cars were fitted with Standard Air-Brake Co.'s gear-driven compressors, the brake cylinders being connected to the ordinary wheel-brake rigging. In 1901 the Board of Trade required slipper brakes to be used on some of the routes, and several cars were fitted with Hewitt & Rhodes brakes, the old compressor gear being retained. Since that time the slipper brake has been fitted to the remainder of the cars.

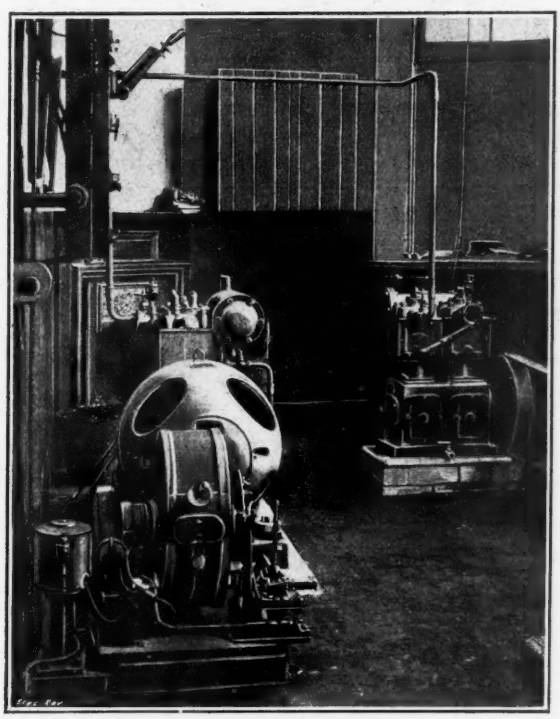
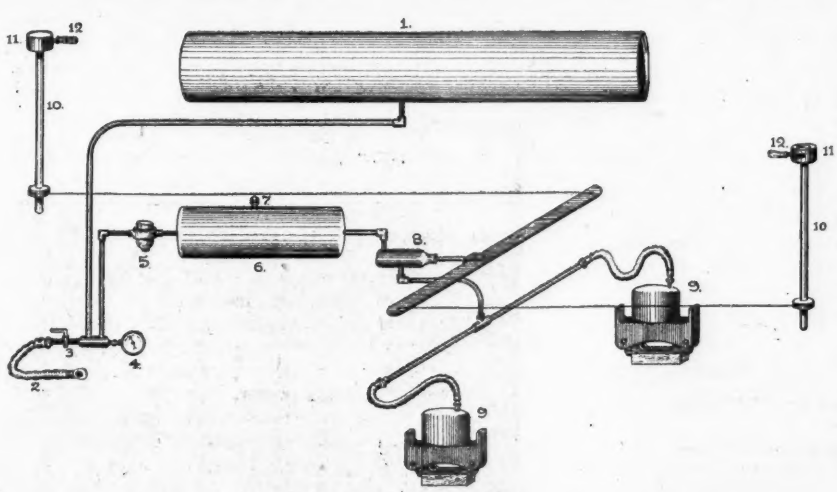


Fig. 2.—Air-Compressor Plant at the Car Shed.



1. H.P. Reservoir.
2. Charging Coupling.
3. Charging Cock.
4. H.P. Gauge.
5. Reducing Valve.
6. L.P. Reservoir.
7. Relief Valve.
8. Operating Valve.
9. Brake Cylinders.
10. Operating Spindles.
11. L.P. Gauges.
12. Detachable Operating Handle.

Fig. 4.—Arrangement of Air-Slipper Brake Equipment.

The comparatively heavy upkeep costs of the compressors led to experiments being made with an air storage system, and lately some 20 cars have been thus fitted. These cars are of the single deck, single truck pattern, weighing about 7 tons, and two slipper cylinders are fitted to each.

The general arrangement of the equipment is shown in fig. 4, and fig. 3 gives the general appearance of a car when fitted; the storage cylinder is, however, normally hidden by an advertisement board. The air is stored in a steel reservoir which is placed on the roof of the car; this has a capacity of about 12 cb. ft., and is charged with air at 150 lb. pressure. The air passes through a reducing valve, and is used at about 40 lb. pressure. The operating valve is placed in the centre of the car, and is worked from each platform by rods and chains. A small gauge is fitted to each operating standard, which shows the pressure in the low-pressure reservoir, and another gauge at the side of the car shows the pressure available in the main reservoir. The charging couplings and reducing valve are of the standard Westinghouse pattern.

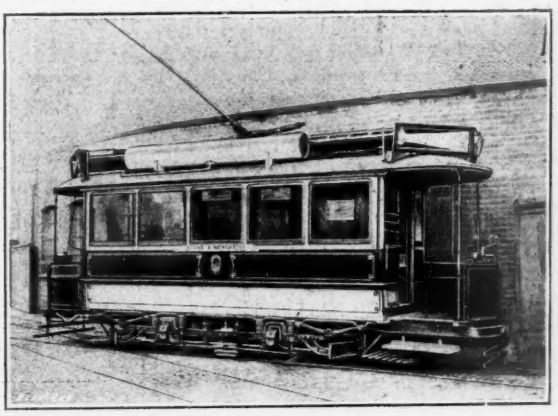


Fig. 3.—Car fitted with Air-Storage Cylinder.

The compressor plant is installed in one of the car-sheds, and consists of two motor-driven two-stage compressors, each having a capacity of 30 cb. ft. per minute, and working up to 200 lb. pressure. Both compressors were supplied by Messrs. Brotherhood, one being gear-driven from a 10-H.P. Siemens motor, and the other belt-driven from an old bi-polar motor that was available.

The motors are started by means of a liquid starter made by the Sandycroft Foundry Co., which is of such a capacity that either one or both motors may be started as required. The starter, which is automatic, is arranged to cut out when the desired pressure is obtained, and to start again when the pressure drops, the range being about 15 to 20 lb.; a no-voltage release is also fitted.

The compressors charge a reservoir of about 150 cb. ft. capacity, and from this a pipe-line is led round the shed walls with charging connections at intervals. The car reservoirs are charged just before the car goes into service, and, if necessary, they are recharged on the road by means of a hose-pipe led from the shed which, in this case, is very near the track. In future installations it is proposed to provide a small manhole between the tracks, from which connection can be made when needed. The charging operation, including coupling and uncoupling, takes from 40 to 60 seconds.

On this system the practice is to use the air-slipper brake as an emergency brake, the term "emergency" in this case

having a wide interpretation, and including any stops that cannot be made quickly or safely enough by means of the hand brake. The storage provided is sufficient for from 8 to 16 hours, according to the conditions experienced.

Tests recently taken show that, in emergency, a bogie car weighing about 10 tons and fitted with four brake cylinders can, on a fair rail, be stopped on a grade of 1 in 10 in a distance of 80 ft., the initial speed being 15 miles per hour. On the level, the same car, travelling at 11½ miles per hour, was brought to a stand in 39 ft., while on a rail that had been greased to such an extent that a car could not start on it without sand, the stopping distance was on the level increased to 48 ft., the speed in this case being 12¼ miles per hour.

In extreme emergency the rheostatic, or electrical emergency brake, one or other of which is usually fitted to a car, can be used in addition to the slipper brake, without fear of their mutual interference, and, in this case, the stop made is extremely abrupt.

It is obvious that, even if the wheels have been skidded by the hand brake, the slipper is still effective, and this latter is so quickly and easily applied that there is little likelihood of the car becoming a runaway.

The operating valve is arranged to give "release," "lap," "service" and "emergency" applications, and by moving the handle to "service" and then back to "lap," very little air is used, and a smooth stop can be made, the elasticity of the air in the brake cylinders preventing any very harsh applications. The tendency to derail the car is very slight; in fact, as the blocks generally wear with a flange that enters the rail groove, the tendency is probably non-existent, and there is no record of a car having been derailed from this cause. On the other hand, should a car leave the metals from any other cause, the brake is still effective.

We understand that several cars on the Manchester Corporation Tramways have been recently fitted with air slipper brakes for experimental purposes, and, in this case, an improved type of chain-driven compressor made by the makers of the brakes, Messrs. Estler Bros., has been adopted. The brake has also been in use on many of the Oldham cars for some years.

We may also mention that the air storage system is used on a large scale on the Brussels Tramways, the air cylinders working on the wheel brakes. In this case trailers are used during certain hours of the day, the trailer brakes being operated in the same way from the motor-car. The system is also used in Detroit, Toronto and other places.

ELECTRICAL PLANT AT THE BROWNLOW HILL WORKHOUSE, LIVERPOOL.

The Brownlow Hill Workhouse, Liverpool, is one of the largest, if not the largest, Poor Law institutions in the country, having an inmate population of about 4,000 apart from the officers and nurses. It has a hospital capacity of about 2,000 beds, and is the largest nursing training-school in Great Britain.

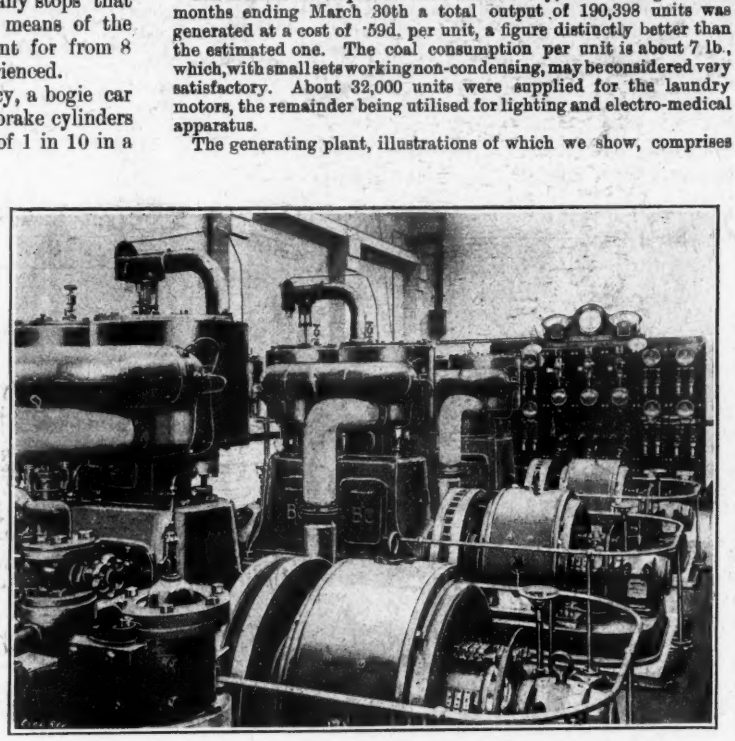
The buildings, some of which have been converted from ordinary workrooms to hospital wards, are mainly old; up till recently the whole of the buildings except the nurses' home were lighted by gas, and the laundry, which is a large one dealing with 50,000 articles a week, was driven by a steam engine.

The members of the select vestry, realising that it would certainly be more satisfactory, and probably more economical, to have an electrical installation, decided to seek advice on the matter, and instructed Messrs. T. L. Miller & Wilson, of Liverpool, to submit a report on the subject.

This when prepared showed that, allowing for an expenditure of £10,000, and after providing for all capital charges on this amount, a saving of about £700 per annum might be anticipated if the buildings were lighted and motive power supplied from a central generating plant. Acting upon this advice, the consent of the Local Government Board was obtained by the vestry, and work commenced in January of last year, the plant starting operation in September of the same year.

The results have proved most satisfactory, and during the six months ending March 30th a total output of 190,398 units was generated at a cost of ·59d. per unit, a figure distinctly better than the estimated one. The coal consumption per unit is about 7 lb., which, with small sets working non-condensing, may be considered very satisfactory. About 32,000 units were supplied for the laundry motors, the remainder being utilised for lighting and electro-medical apparatus.

The generating plant, illustrations of which we show, comprises



Electrical Generating Plant at the Brownlow Hill Workhouse, Liverpool.

three 120-h.p. high-speed enclosed type Brush engines direct connected to three 85-kw. generators by the same firm. These machines give a normal output of 370 amperes at 230 volts.

The steam raising plant consists of two 28 ft. × 7 ft. 6 in. Lancashire boilers by Messrs. Galloways, of Manchester, each boiler having a downtake superheater of the "Easton" type. The boilers work at a pressure of 120 lb. and steam is delivered to the engines with about 100° superheat.

The feed pumps and feed tank are at one end of the engine house, the pumps being of the "Cameron" type. The steam piping

The Main Switchboard, Brownlow Hill Workhouse Plant.

is arranged so as to allow either boiler to supply any engine, and the valves are so placed as to render a total stoppage impossible.

The switchboard consists of three generator panels in the centre of the board, and four feeder panels arranged two on either side.

The system of mains supplying the various blocks consists of bare copper conductor laid solid in "carbolite" in wood troughing, and has given every satisfaction.

The lighting installation comprises 27 arc lamps, some of which are used for outside lighting, and about 3,000 16-c.p. incandescents, the bulk of the wiring being done in wood casing.

The laundry installation, which is very interesting, comprises five 16-h.p. 400 r.p.m. motors built by the British Electric Plant Co.; electrically-heated finishing machines, and a large number of

electrically-heated irons. Very great benefit has been derived from the abolition of the gas-heated irons previously used.

In the operating theatres and hospital wards, a considerable amount of electro-medical apparatus has been installed, including a large number of electrically-heated sterilisers.

The generating and steam raising plant are located in a substantial brick building, divided into two rooms of equal size, the main dimensions being 50 ft. by 21 ft. each; the main flue from the boilers leads to a brick chimney 90 ft. high.

The result of the first six months' working shows that the anticipated saving of £700 should be realised, and great credit is due to Mr. W. P. Elliott (the engineer in charge) for the economical running of the plant.

The contractors for the wiring were Messrs. The Alliance Electrical Co., Ltd., of Birmingham, and for the switchboard and motor-starting panels Messrs. Brook, Hirst & Co., of Chester. The pipework was carried out by Messrs. E. H. Williamson & Co., of Liverpool.

The whole of the work was executed under the supervision of Messrs. T. L. Miller & Wilson.

PROCEEDINGS OF INSTITUTIONS.

A New Leading-in Conductor for Electric Lamps.

By C. O. BASTIAN, Member.

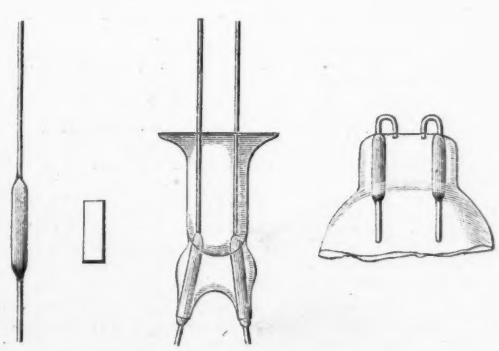
(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *at Glasgow, May 14th*, 1907.)

THE difficulty of permanently maintaining a vacuum in an electric lamp is not satisfactorily overcome by the use of platinum for the leading-in conductors, as the costliness of this metal tempts the lamp maker to exercise excessive economy in the cross-section and length of the platinum used, and leaky seals may be the result.

In the Siemens seal the platinum is completely embedded in glass, being merely a bridge between two heavier conductors, usually of copper and nickel. The cooling effect of these two heavy conductors, plus the cooling effect of the mass of surrounding glass, permits the use of platinum having a very small cross-sectional area, and theoretically—though not practically—the length of platinum wire may be cut down to a minimum.

The recent rapid and considerable rise in the price of platinum is calculated to lead many to attempt a reduction below the limits of safety, and the introduction of some cheap and effective substitute for platinum, which would not be subject to wide fluctuations in price, is now more than ever desirable.

Nickel and steel can be alloyed in such proportions as to have practically the same coefficient of expansion as glass, but leading-in wires of this alloy have not found favour in this country, although it is used in certain cheap foreign-made lamps. The



surface of the wire becomes oxidised during the sealing-in process, and the thin layer of oxide is sufficiently porous to allow air to gradually percolate through, so that lamps made with this nickel-steel alloy cannot be stocked for any reasonable length of time without deterioration.

The leading-in conductor to be described is the result of experiments extending over several years in the author's laboratory, the final solution of the problem being due to the ingenuity of Mr. George Calvert.

A copper wire of any desired gauge is selected, of sufficient length to extend from the lamp cap to the filament. Near one end, and along 15 mm. of its length, this wire is rolled flat to a thickness of 0·075 mm., as shown in fig. 1.

Next a 10-mm. length of soft enamel glass tube is slipped over the flattened portion of the conductor, and is melted on to it with a blow-pipe flame. Under suitable conditions, the enamel glass can be melted on to the flat copper without the latter oxidising in the slightest degree, and the enamel will then adhere to the clean polished metallic surface just as solder would adhere. The enamel and copper appear to be actually joined together.

This glass-coated metal can now be heated up to any desired temperature short of the melting point of the copper, without the latter becoming oxidised, because the glass coating will effectually prevent the access of oxygen to the surface of the metal underneath it. There is, therefore, nothing to prevent conductors thus prepared being sealed into a lamp stem, as shown in fig. 2; such seals have proved most perfect in practice, and have successfully withstood the very severe tests to which they have been subjected during the last eight months.

Out of the first batch of carbon filament lamps made with these leading-in wires—Sineplat wires, as they are termed by the makers—30 were selected for a "life" test. They were arranged in two separate groups of 15 each, and connected with a time switch, so that each group was alternately lit for 10 minutes and out for 10 minutes—long enough for the seals to get thoroughly hot and then thoroughly cold. This run was continued for 500 hours; then the time switch was disconnected and the lamps were given a continuous run for a further 1,000 hours. During this test none of the lamps failed through deterioration of the vacuum.

An examination of these particular lamps shows that there has been surprisingly little blackening of the bulbs; it is not generally appreciated how greatly this blackening is dependent on the degree of vacuum maintained.

The conclusions deduced from the test above described have been amply confirmed by several other independent trials, and it is now clear that the Sineplat seals are consistently good when made by hand, whilst preliminary tests with machine-made lamps promise equally satisfactory results.

As the proportion of surface area to mass of copper is increased, so is the cracking strain of the copper upon the glass reduced, and if the copper is flattened below the point of critical thickness, then no cracking will result. For the lead glass usually employed by lamp manufacturers, this critical thickness has been determined by experiment at about 0·1 mm., and with this gauge of copper about 50 per cent. of the seals will crack, but below this gauge—0·075 mm.—no cracking whatever takes place, even though the projecting copper wire be raised to a red heat close up to the glass.

The cheapness of the metal permits of a much larger cross-section being used than would be possible with platinum, and added to this there is the higher conductivity of the copper to assist in keeping the seal cool.

The introduction of a substitute for platinum is not likely to result in any reduction in the price of lamps to the public, as any economy that the manufacturer may effect as a result of this should be set off by improving the quality of the lamp in some other respect.

Physical Society.

AT the meeting held May 24th, 1907, Prof. J. Perry, F.R.S., President, in the chair, a paper on "The Measurement of Mutual Inductance by the aid of a Vibration Galvanometer," was read by Mr. A. Campbell. Carey Foster's method of comparing a mutual inductance with a capacity is one of the most convenient methods, and the formula is very simple, being $M = KR_1r$, where K is the capacity (in farads) and R and r are resistances. The great advantage gained by the use of a *vibration galvanometer* in methods for measuring capacity or inductance led the author to apply it to the Carey Foster and the Hughes-Rayleigh methods. He found, however, that with alternating currents it was necessary to modify the Carey Foster method by adding a series resistance in the condenser branch; this left the formula $M = KR_1r$ unaltered and gave an additional formula involving the ratio of a mutual and a self-inductance. The modified method is extremely convenient, the two adjustments required for a balance being independent and the result not involving a knowledge of the frequency; the use of the vibration galvanometer is a great improvement, making the method independent of the wave-form of the current used. If the detecting instrument used in a null method (with alternating current) is adjusted so that its natural period is in tune with that of the applied voltage, it will be set into strong resonance and will be enormously increased in sensitivity for this particular frequency, practically ignoring in comparison all the other components of the wave-form.

The author exhibited a vibration galvanometer having a moving coil controlled by an adjustable bifilar suspension. By adjusting the tension of this the tuning is very easily effected. For measuring the frequency to which a tuned instrument is responding, it is convenient to use the Hughes-Rayleigh method, in which a known self-inductance is compared with an unknown mutual inductance, the balance being dependent on the frequency. The author showed such an arrangement in which the slide-wire was graduated directly in frequency. With accurately known frequency on the other hand, the method gives absolute values of L and M.

In conclusion the author gave results of tests (by several methods) of a standard mutual inductance of 0·05 henry. The Kirchhoff method with direct deflection on a ballistic galvanometer (of measured time of swing) gave a mean of 0·05014 henry, while the Carey Foster method gave 0·05009 henry; the probable error of the latter was much smaller than that of the older method.

Mr. A. RUSSELL considered that the bifilar method of suspending the vibrating coil was a great improvement on the single-wire method. To work such an instrument at its greatest sensibility, it must be most accurately tuned, and it must be supplied with a current of almost absolutely constant frequency. When used to measure currents, the shape of the wave must be known.

Mr. ROLLO APPLEYARD said the author's method should be applicable to the case of an inductance shunted by a capacity. In that event it would be useful for measurements of the inductance of telephone cables, and it would afford a rapid means of deter-

mining the "attenuation constant," when frequency was of importance.

Mr. Campbell, in reply to Mr. Russell, said that the modified Carey Foster method, with a mica condenser, gave results in such close agreement with the first formula, that it precluded the possibility of any apparent resistance in the condenser of the order observed in certain condensers by Rowland and Mr. Russell.

A "Note on the Rate of Decay of the Active Deposit from Radium," by Messrs. W. Wilson and W. Makower, was taken as read.

Mr. S. G. Brown exhibited "Apparatus for Relay Working of long Submarine Telegraph Cables."

NEW PATENTS APPLIED FOR, 1907.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

13,782b/06. "Improvements in and connected with electric motor-generators." H. Leitner. (Date applied for under Rule 5 of the Patents Rules, 1905, June 15th, 1906.) June 4th.

12,761. "Improvements connected with telephone transmitters and receivers." H. Jankelowitz. June 3rd. (Complete.)

12,765. "Electric resistances and electric resistance heaters." F. Soddy. June 3rd.

12,773. "Improved means of excitation for the dynamos of petrol-electric cars and for other purposes." W. A. Stevens. June 3rd.

12,788. "Improvement in and connected with trolley poles of electric tramcars." C. H. Humphreys. June 3rd.

12,795. "Earth anchor for anchoring telegraph and telephone poles, tents, and the like." C. E. Frost. June 3rd. (Complete.)

12,807. "Improvements in or relating to electric traction on the surface-contact system." J. O. Oxley and D. Suchostawer. June 3rd.

12,808. "Improvements in or relating to electric traction on the surface-contact system." J. O. Oxley and D. Suchostawer. June 3rd.

12,810. "Improvements in trolleys or collectors for electric railways and tramways." H. Tompkins. June 3rd.

12,826. "Electrically-heated trouser presser." A. N. Thaller. June 3rd.

12,857. "Improvements in ball and socket joints for gas, electric light and other like fittings." J. Tondy. June 3rd.

12,860. "Contactor commutator for dynamo-electric machines." H. R. Rivers-Moore and J. M. Donald. June 4th.

12,871. "Electrically-heated vulcaniser." F. J. Gornall. June 4th.

12,890. "Improvements in and relating to burglar alarms." J. Gaynor. (Date applied for under Patents Act, 1901, August 25th, 1906, being date of application in United States.) June 4th. (Complete.)

12,902. "Improvements in and relating to enclosed electric arc lamps." B. A. Quint. June 4th.

12,907. "Electrical counter and indicating gear." L. Newitt. June 4th.

12,913. "Improvements in reciprocating electric motors." R. P. Irving. June 4th. (Complete.)

12,932. "Improvements relating to electrical transmission circuits." The British Westinghouse Electric and Manufacturing Co., Ltd. (The Westinghouse Electric and Manufacturing Co., United States.) June 4th. (Complete.)

12,937. "Improvements in compensated alternate current series motors." Felten and Guilleaume-Lahmeyer-Werke Act.-Ges. (Date applied for under Patents Act, 1901, July 12th, 1906, being date of application in Germany.) June 4th. (Complete.)

12,960. "Improvements in receiving apparatus for wireless telegraphy." Marconi's Wireless Telegraph Co., Ltd., and C. S. Franklin. June 4th.

12,967. "Improved switch for controlling electrical circuits." T. J. Rorke and E. Rorke. June 4th.

12,968. "Improved means for holding electrical condensers and the like." Marconi's Wireless Telegraph Co., Ltd., and R. D. Bangay. June 4th. (Complete.)

12,973. "Improvements in brake leverage systems." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) June 4th.

12,979. "Operating printing types electrically." W. McPerson. June 4th.

13,021. "Improvements in brush-holders and carriers for electric generators and motors." A. E. Woodhouse. June 5th. (Complete.)

13,022. "Improvements in or connected with induction coils and the like, particularly applicable for use with internal combustion engines." L. Mantell, Jun., and S. Wolf. June 5th.

13,032. "Improvements in systems for electric railways." A. C. Eastwood. June 5th. (Complete.)

13,044. "Improvements in and in connection with insulators for telegraph, telephone and like wires." F. R. Webb. June 5th.

13,059. "Improvements in or connected with holders for incandescent electric lamps." L. Sunderland and G. C. Pillinger. June 5th.

13,062. "Improved photometer for testing the luminous power of electric lamps." G. Bartels. June 5th. (Complete.)

13,069. "Improved circuit breaker for petrol electric cars and for other purposes." W. A. Stevens. June 5th.

13,071. "Improved electrode for search lights." Gebruder Siemens & Co. (Date applied for under Patents Act, 1901, June 8th, 1906, being date of application in Germany.) June 5th. (Complete.)

13,072. "Improvements in controllers." H. E. White. (Date applied for under Patents Act, 1901, June 6th, 1906, being date of application in United States.) June 5th. (Complete.)

13,073. "Improvements in alternating-current electric motors." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) June 5th.

13,102. "Improvements in the insulation of submarine cables for telegraphic and telephonic purposes." J. Johnston. June 6th.

13,107. "Improved method of attaching electrical testing and recording instruments to electrical circuits." R. T. Smith and A. G. Beaver. June 6th.

13,129. "Apparatus for the electric lighting and heating of vehicles." H. Grob. (Date applied for under Patents Act, 1901, June 9th, 1906, being date of application in Germany.) June 6th. (Complete.)

13,137. "Improvement in the deposition of metallic alloys by electrolysis." R. B. Wheatley and F. B. Lark. June 6th.

13,140. "Improved system of controlling and operating motors for electric railways and power plants." J. Sahulka. June 6th. (Complete.)

13,151. "Improvements in or relating to brackets for electric lamps." A. Loebl. June 6th.

13,175. "Improvements in telephone selecting apparatus." W. D. Watkins, J. W. Bolster and W. E. Goodsell. June 6th. (Complete.)

13,177. "Improvements in variable speed dynamos." H. Leitner. June 6th.

13,184. "Improvements in incandescent electric lamps." T. W. Lowden. June 6th.

13,190. "Improvements in electrodes for electric arc lamps and in lamps for their consumption." H. T. Harrison and H. Hirst. June 6th.

13,195. "Improvements in and relating to signalling systems for railways and the like." British Thomson-Houston Co., Ltd. (Allgemeine Elektricitäts-Ges., Germany.) June 6th.

13,196. "Improvements in electric insulators." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) June 6th.

13,206. "Improved controlling system for electric railways." W. Arthur. June 7th.

13,248. "Improvements in portable electric plants." G. F. R. Turner. June 7th.

13,256. "Improvements in and relating to the supply of electric current by the three-wire system." A. E. Tanner. June 7th.

13,259. "Improvements in brush-holders for dynamos and motors." H. N. Hickley. June 7th. (Complete.)

13,262. "Improvements relating to receivers for electro-magnetic waves." A. Artom. (Date applied for under Patents Act, 1901, January 10th, 1907, being date of application in France.) June 7th. (Complete.)

13,265. "Improvements in and relating to controller for alternating-current motors." Allgemeine Elektricitäts-Ges. (Date applied for under Patents Act, 1901, June 8th, 1906, being date of application in Germany.) June 7th. (Complete.)

13,270. "Improvements in mercurial thermostatic circuit closers." F. Cossor. June 7th.

13,274. "Improvements in couplings for electric cables." W. Middleton and J. Y. Middleton. June 7th. (Complete.)

13,278. "Improved electric circuit-breaker." G. O. Larsson. (Date applied for under Patents Act, 1901, June 7th, 1906, being date of application in Sweden.) June 7th. (Complete.)

13,285. "Improvements relating to the protection of alternating-current induction motors." G. Ellison. June 8th.

13,298. "Improvements in continuous-current electricity meters." R. Kennedy. June 8th.

13,322. "Improvements in the mariner's compass." J. D. H. Morton. June 8th.

13,342. "Improvements relating to the electrical treatment of gases or vapours, and especially of air or oxygen, for the production of ozone, and in apparatus therefor." J. E. Richardson and J. A. Vaughan. June 8th.

13,349. "Improvement in electrical signalling installations constantly fed with current." Siemens Bros. & Co. (Siemens & Halske Act.-Ges., Germany.) June 8th. (Complete.)

13,354. "Improved method of attaching filaments to the leading-in wires of electric incandescent lamps." F. P. Driver. June 8th.

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool, price, post free, 9d. (in stamps).

1906.

Ships' or Analogous Electric Telegraphic Apparatus. C. J. Montgomery. 3,172. February 9th.

Electric Circuit Breakers. G. G. Stout. 11,058. May 11th.

Electro-Magnetic Power Transmission Apparatus. A. P. Zani. 11,462. May 16th.

Devices for Connecting the Conductors of Electric Circuits, more Especially Intended for Use in the "Wiring" of Buildings for Electric Lighting. E. L. Berry and F. Harrison. 11,676. May 18th.

Manufacture of Incandescing Bodies for Electric Incandescent Lamps. A. Just, F. Hanamann and Vereinigte Elektricitäts Act.-Ges. 11,944. May 22nd.

Methods of Suspending the Conducting Wire of Electric Railways and the Like. British Thomson-Houston Co., Ltd. (Allgemeine Elektricitäts Ges.) 12,821. June 1st.

Apparatus for Enabling the Transformation of a Single-Phase Alternating Current into a Continuous Current. L. R. Auvert and F. E. Ferrand. 13,585. June 13th. (Date applied for under International Convention, July 3rd, 1905.)

Electric Switches. British Thomson-Houston Co. (General Electric Co.) 13,601. June 13th.

Electric Starting Machines having Fly-wheels that can be Uncoupled Therefrom when Working with Light Loads. Siemens Bros.' Dynamo Works, Ltd. (Siemens Schuckertwerke G.m b.H.) 14,945. June 30th.

Systems of Electric Motor Control. British Thomson-Houston Co. (General Electric Co., U.S.A.) 15,223. July 4th.

Electric Starting Switches and Regulators. E. T. Allan. 16,819. July 25th

Signalling Apparatus for Electric Railways. A. Parusel. 17,071. July 28th.

Mode of and Means for Electrically Treating Air and other Gases. J. H. Bridge. 17,768. August 7th.

Commutator Switch for Two Igniting Sources of Electricity. A. Horch. 18,083. August 11th.

Instruments for Indicating the Flow of Currents of Electricity Through Conductors. S. J. Ross. 18,135. August 13th.

Electric Switch Mountings. P. Olver and J. W. Crawford. 19,299. August 29th.

Electric Incandescent Lamps. J. W. Forster. 19,620. September 3rd.

Supports for Metallic Filaments for Electric Incandescent Lamps. A. Lederer. 20,210. September 11th.

Electric Arc Lamps. British Thomson-Houston Co. (Allgemeine Elektricitäts-Ges.) 20,463. September 14th.

Electrical Resistances. V. J. Davy. 20,703. September 18th.

Electrolytic Production of Copper Wire Strip or the like. S. O. Cowper-Coles. 21,349. September 26th.

Electric Condensers or the like. J. A. L. Dearlove and S. G. Brown. 22,715. October 13th.

Magnetic Separators. M. Ruthenburg. 24,422. November 15th.

Apparatus for Detecting whether Railway or like Points are in their Correct Position, and an Electrical Switch for Use Therewith. Siemens Bros. & Co. and L. M. G. Ferreira. 26,983. November 27th.

Electro-Deposition of Iron. S. O. Cowper-Coles. 28,897. December 18th.

Multiple-Unit Controlling Systems for Electric Railway Trains and the like. Allmanna Svenska Elektriska Aktie-Bolaget. 29,771. December 31st. (Date applied for under International Convention, January 2nd, 1906.)